RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES
PUBLISHED BY THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

VOL. 27 NOVEMBER, 1936 NO. 5

# HEART MEASUREMENTS[1]

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LEADING heart authorities agree that general enlargement of the heart is the most reliable proof of heart disease.

Bedford and Treadgold (4) state: "It is not going too far to say that enlargement of the heart is the most unequivocal single sign of heart disease which is generally applicable."

Eyster (11, 12) states: "The differentiation of the enlarged heart from the heart of normal size is the most important single factor in determining the presence or absence of organic heart disease. With the exception of mitral stenosis and atrophic myocarditis, all but the rarest types of organic heart disease lead to hypertrophy of the ventricles. Except in rare instances, the left ventricle is most affected in the types with which the physician has to deal. This chamber is most affected in double mitral disease, in aortic disease, in adherent pericardium, in arterial hypertension, and in myocardial degeneration associated with syphilitic or other types of aortitis and arterial injury."

Christian (5) quotes Cabot as saying: "Seventy-seven per cent of all heart disease is due to simple hypertrophy and dilatation of the heart (or hypertensive cardiovascular disease) without valve lesions."

Christian further states: "At the Peter Bent Brigham Hospital they form 61.1 per cent of the patients admitted to the wards suffering from chronic heart disease.

"At any rate in a clinical sense, it does seem true that any heart, demonstrably enlarged, is to be regarded as a damaged organ, which before very long will give evidence of inefficiency."

Christian defines chronic myocardial disease as, "that form of cardiac failure in which valves and pericardium are normal in appearance. Usually there is hypertrophy and dilatation of the heart. In a large percentage of the cases the heart muscle shows no demonstrable lesion beyond hypertrophy; in a small percentage there is fibrous myocarditis."

Sir James Mackenzie (33) states: "Dropsy of cardiac origin never occurred without dilatation of the heart."

Sir Thomas Lewis (31) states: "The reasons why enlargement affects prognosis are that enlarged hearts are far more prone than are small ones abruptly to display signs of failure; that they are more apt to suffer from thrombotic accidents, coronary or endocardial, the latter leading to embolism; and that they tend more to acquire serious disorders of beating."

Willius and Smith (47), in reporting autopsies on a series of rheumatic cases, state: "The greatest average cardiac weight

[1] Read before the Midsummer Radiological Conference in the Rocky Mountains, Aug. 5, 6, 7, 1936, Denver, Colorado. Sponsored by the Denver Radiological Club.

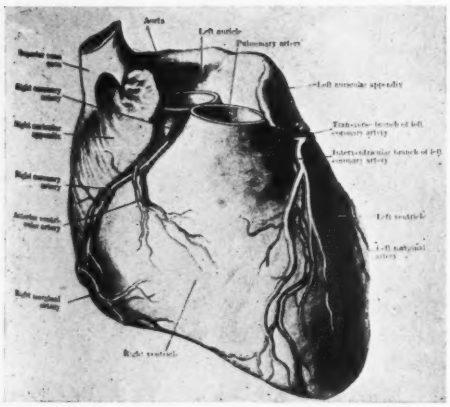

Fig. 1. The antero-superior surface of the heart. (*Cunningham's Anatomy.*)

occurred in cases of aortic stenosis. In order of cardiac weight, other lesions occurred in the following sequence: aortic insufficiency, multiple valvular lesions, mitral stenosis and insufficiency, and pure mitral insufficiency."

It is also well to bear in mind that individuals having small vertical hearts, the asthenic type, are predisposed to neurocirculatory asthenia.

Fluoroscopy, orthodiagraphy, and teleroentgenography are the commonly accepted roentgenologic methods of examining the heart. Each has distinct advantages and all should be used. The two latter are especially adapted to actual heart measurement.

In orthodiagraphy, an outline of the heart is drawn upon a sheet of paper or upon a glass under the fluoroscope by tracing with a small beam of x-ray, giving it a more accurate outline and with less distortion. The apex of the heart and the junction of the left auricle and left ventricle are more accurately located. It requires considerable skill and practice to attain accuracy; there is considerable variation in the tracings of the same individual by the same observers at different times, and often a marked difference when taken by different observers.

Teleroentgenography eliminates the personal equation and gives a permanent record which can be accurately reproduced. If the film is taken at 6 or 7 feet (2 meters), the distortion is not great. However, by

Fig. 2. Heart in frontal position. (*Vaquez and Bordet.*)

this method it is difficult to determine the exact location of the apex and the junction of the left auricle and left ventricle on the left border of the heart.

Measurements based upon the two methods are not interchangeable; measurements taken in the erect, sitting, or reclining position by either method are not interchangeable.

It would be quite desirable to determine the exact size of the heart and its various muscular divisions, but insurmountable difficulties prevent it.

The postero-anterior silhouette and the orthodiagraphic tracing of the heart in this position can be fairly accurately measured. Oblique and lateral views, because of distortion, cannot be accurately measured. Hearts having the same area may vary in volume because of different depths.

The anatomic location of the chambers of the heart does not correspond with the silhouette.

An examination of the heart in the anteroposterior position shows the arrangement of the visible portions to be as follows: The right ventricle comprises the major portion of the anterior surface, its lower border lying on the diaphragm. The right border of the heart is composed almost

entirely of the right auricle. Only a narrow strip of the left ventricle is seen on the left border and above this only a minute portion of the left auricle is exposed to view. Above the base of the heart in the midline, the aorta is seen on the right and the pulmonary artery on the left. The junction of the right auricle and right ventricle is at the junction of the heart with the diaphragm.

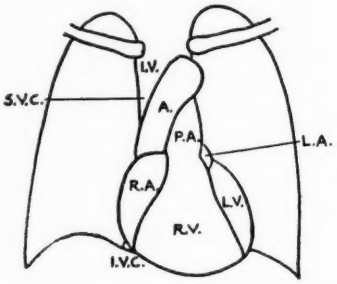


Fig. 3. Normal heart; anteroposterior view. (*East and Bain.*)

I.V.—innominate vein.
S.V.C.—superior vena cava.
R.A.—right auricle.
I.V.C.—inferior vena cava and right hepatic vein.
R.V.—right ventricle.
A.—aorta.
P.A.—pulmonary artery.
L.A.—left auricle.
L.V.—left ventricle.

The contour of the right side of the silhouette of the heart and vessels is made up of two main arches or convexities. The upper arch consists of the first part of the aorta and the superior vena cava; the lower and larger arch consists of the right auricle. On the left side, there are four arches, from above downward, as follows: (1) posterior portion of the aorta; (2) pulmonary artery; (3) left auricle; (4) left ventricle.

In measuring the silhouette of the heart, the following lines are generally drawn:

1. A vertical line through the spinous processes or midway between the heads of the clavicles is called the *midline*.

2. An oblique line drawn from the junction of the great vessels and the right auricle on the right border to the apex of the heart is called the *length*, or *long diameter*, or *oblique diameter* of the heart.

3. A horizontal line is drawn from the farthest point on the right to the midline; another horizontal line is drawn from the farthest point on the left to the midline, and the sum of these two lines is called the *transverse* diameter. This is not a true diameter of the heart and varies with the angle of inclination of the heart. It does not pass through the same areas at even approximately the same angles in different types of hearts, consequently, in using it for comparison you are comparing diameters of entirely different structures. This diameter should be discarded.

4. A perpendicular line is drawn from the junction of the left auricle and left ventricle on the left border of the heart to the oblique diameter. A second perpendicular line is drawn from the junction of the right side of the heart and diaphragm,

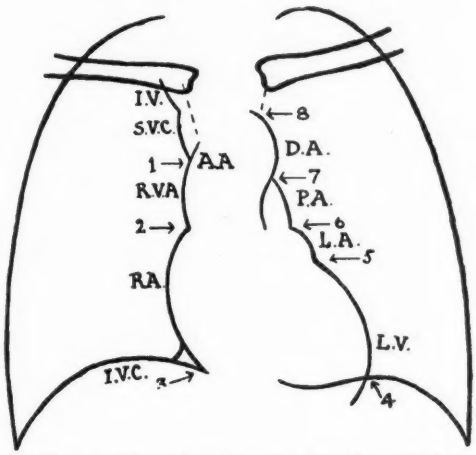


Fig. 4. Normal anteroposterior view of the heart (near view). (*From Köhler.*)

1–8—indicate the notches between the various arches.
R.A.—right auricle.
R.V.A.—right vascular arch.
A.A.—ascending aorta.
L.V.—left ventricle.
L.A.—left auricle.
P.A.—pulmonary artery.
D.A.—descending aorta.
I.V.—innominate vein.
S.V.C.—superior vena cava.
I.V.C.—inferior vena cava.
3 and 4—The cardiophrenic angles.

which is the junction of the right auricle and right ventricle, to the oblique or long diameter. The sum of these two lines is the *broad* diameter of the heart, which is a fairly accurate and reliable anatomical measurement of the heart at the junction of the auricles and ventricles and should be used for comparison instead of the transverse diameter.

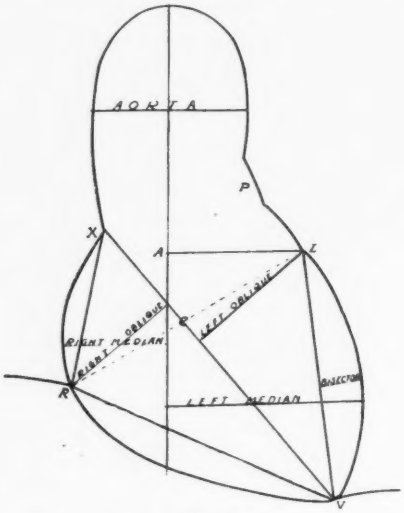


Fig. 5.

L.A.—left auricle.
L.V.—left ventricle.
R.V.—right ventricle.
R.X.—right auricle.
C.X.—C.V. equals index of auricular ventricular ratio; right median plus left median equals transverse.
V.X.—length.
P.—pulmonary artery.
(*Levene and Reid in Am. Heart Jour.*)

The angle of inclination is determined by a horizontal line drawn from the apical end of the oblique or long diameter to the midline. Roesler (39, 40) states: "The average angle is from 43 to 45 degrees. Hearts with an average angle of from 52 to 55 degrees (or greater) are vertical hearts; those with an average of from 32 to 35 degrees are horizontal or transverse hearts. *T* (transverse diameter) is usually in a reverse ratio to this angle. Formulas in which *T* is used increase in reliability when the value of the angle is also introduced."

The angle of inclination varies with the position of the heart in the chest, quite markedly in the asthenic, medium, and sthenic types and, consequently, hearts should be classified according to these types.

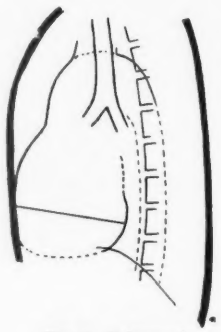

Fig. 6. Schematic drawing of the roentgenologic appearance of the heart and chest as seen in the left lateral view. The diameter of the depth of the heart (*H*D) is indicated. It connects the left ventricular contour, posteriorly, with the inner contour of the sternum, anteriorly, just below where the sternal shadow fuses with the right ventricular contour of the heart. (*H. Roesler, Am. Jour. Roentgenology and Rad Ther.*)

The area of the heart silhouette is determined by plotting it on cross-section paper or by planimetric determination. Either method requires that the curves at the upper and lower ends be completed by continuing the approximate curve of the adjacent borders of the heart, and consequently is subject to a slight error.

The anteroposterior diameter of the heart (depth) is described by Roesler as follows: "Tangents are drawn to the most ventral and most dorsal point of the heart silhouette as seen in the lateral position. The dorsal point is always easily determined. The ventral point is more cephalic and is just below the plane where the heart shadow fuses with the sternal shadow. The line between these two marks is drawn. It

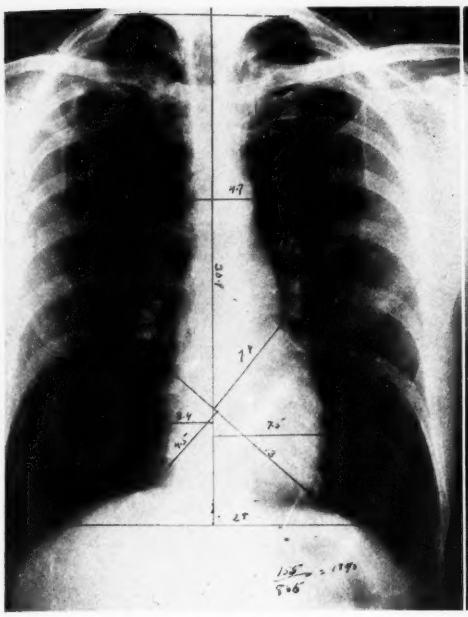

Fig. 7. Asthenic type.

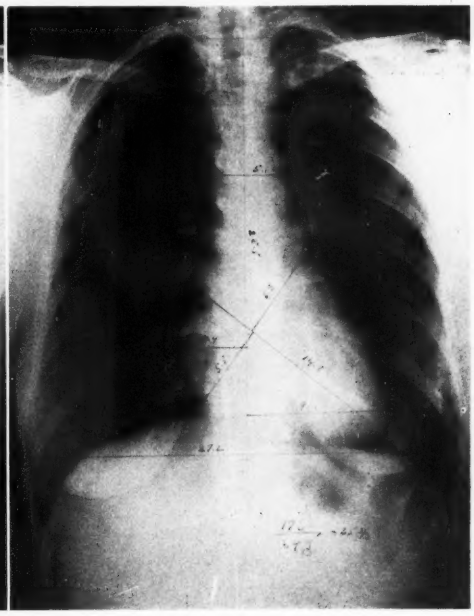

Fig. 8. Medium type.

forms rather a small angle with the horizontal plane. The ventral mark corresponds always to the right ventricular border, the dorsal mark always to the left ventricular border."

Roesler gives the anteroposterior diameter as 8.7 cm. for men and 7.8 cm. for women; maximum for men, 10.7, minimum, 6.7; maximum for women, 9.6, minimum, 6.3 cm. He also gives the average anteroposterior diameter as 73 per cent of the average transverse diameter and 66.3 per cent of the average oblique or long diameter.

Quoting still further from Roesler: "The heart volume would be the area of the sagittal orthodiagram times the greatest depth, times 0.63 or K (Rohrer's constant).

"The constant K depends upon the angulation of the main axis of the heart and the general shape of the heart. Rohrer chose a constant of 0.63 as being in between the paraboloid and spheroid."

The cardiothoracic ratio is the ratio of the transverse diameter of the heart to the width of the lung-field at its greatest diameter. Groedel, according to East and Bain, found this ratio to be 1:1.92. Hammer allowed a variation of 1:1.70 to 2.20 as the limits of normal. This ratio is inaccurate unless it is corrected for the angle of inclination, as the transverse diameter varies with this angle; hence it is gradually being discarded. However, many investigators, particularly the earlier ones, attach a great deal of importance to it.

Bainton states: "It is rather surprising that the cardiothoracic ratio which is so universally employed as a guide in judging the size of the heart should prove to be the poorest standard of all those considered."

Roesler states: "The cardiothoracic ratio should be considered unsatisfactory in determining normal heart size."

Efforts have been made to measure the different chambers of the heart. The following description is taken from Levene and Reid: If the longitudinal diameter is intersected by a line joining the cardiophrenic angle on the right with the auriculoventricular junction on the left, the heart shadow is divided into two areas—the

auricular area above the line and the ventricular area below it. The line joining the cardiophrenic angle on the right with the junction of the great vessels and the auricle shows the development of the right auricle. The line joining the cardiophrenic angle on the right to the apical end of the longitudinal diameter shows the development of the right ventricle. The line joining the junction of the left auricle and left ventricle on the left border to the apical end of the longitudinal diameter, shows the development of the left ventricle. A perpendicular line from the junction of the left auricle and left ventricle on the left to the median line indicates the development of the left auricle.

The bisector, a perpendicular from the point of greatest bulge of the border of the left ventricle to the line measuring its chamber, shows the degree of development of the left ventricular myocardium.

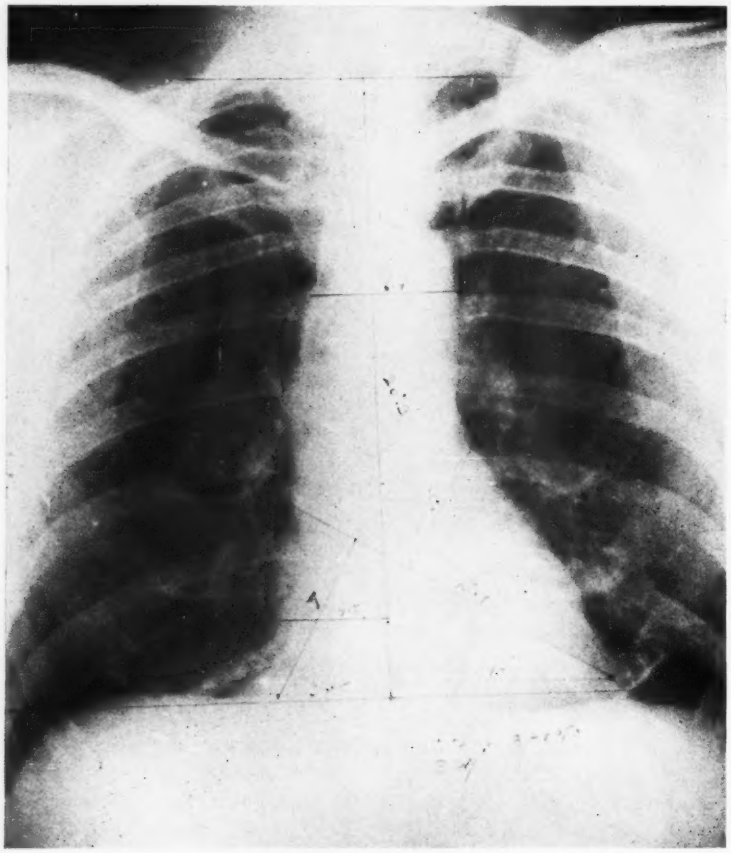

Fig. 9. Sthenic type.

These lines are not true measurements of the anatomical chambers of the heart but are the measurements of the visible portions of these chambers on the heart silhouette.

In order to determine hypertrophy of the heart, it is necessary to determine the size of the normal heart. Numerous tables have been made by different investigators, giving average measurements and upper and lower limits of the area and of the different diameters of the heart. These

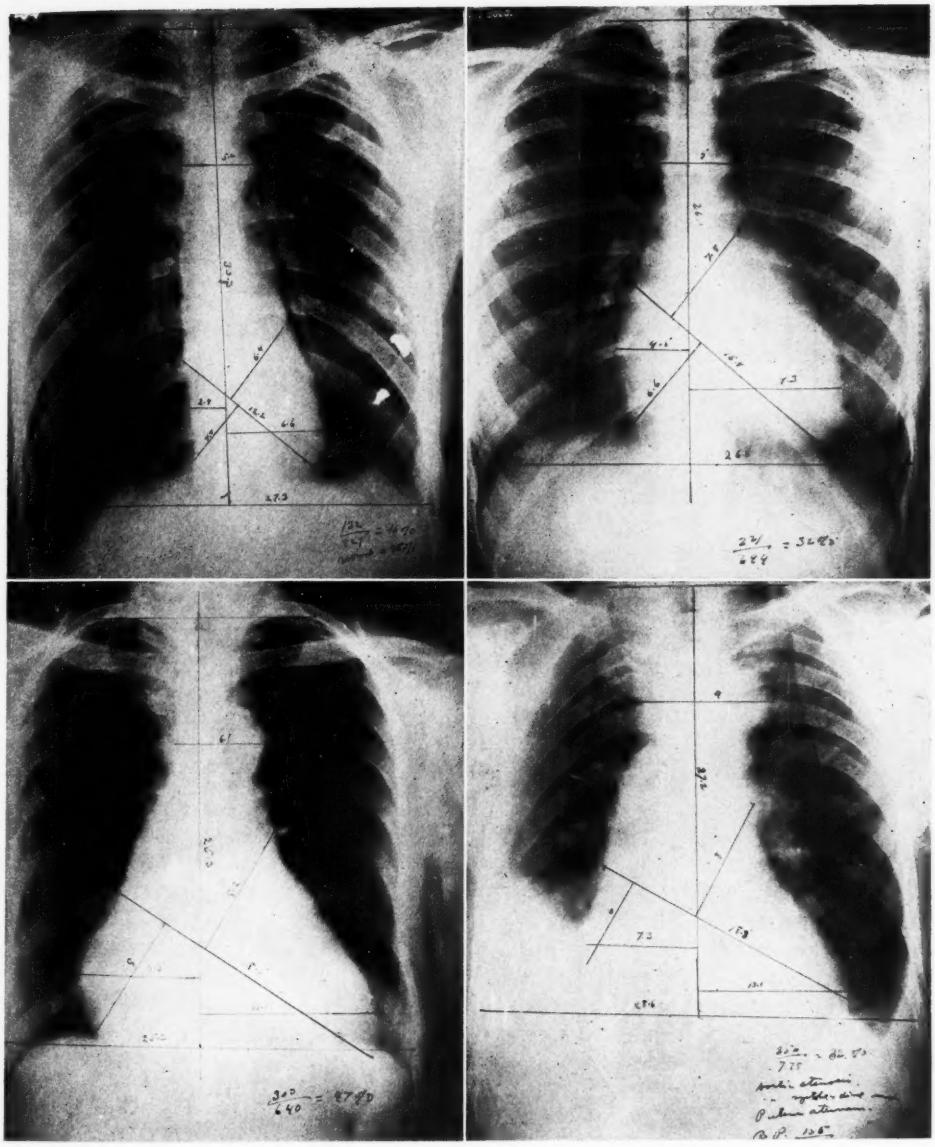

Fig. 10 (*upper left*). Drop heart. Exaggerated asthenic type. $\frac{\text{Rectangle of the heart}}{\text{Rectangle of lung-field}} = 16$ per cent.

Fig. 11 (*upper right*). Enlarged heart due to mitral disease. $\frac{\text{Rectangle of the heart}}{\text{Rectangle of lung-field}} = 32$ per cent.

Fig. 12 (*lower left*). Enlarged heart. Auricular fibrillation. Blood pressure 170/100 $\frac{\text{Rectangle of the heart}}{\text{Rectangle of lung-field}} = 47$ per cent.

Fig. 13 (*lower right*). Cardiac dilatation. Pleural effusion. Systolic and diastolic murmurs at aortic valve. Pulsus alternans. $\frac{\text{Rectangle of the heart}}{\text{Rectangle of lung-field}} = 32$ per cent.

measurements vary with weight, height, age, sex, angle of inclination (habitus), depth of the heart, etc. Different investigators do not attach the same importance to these different factors.

Several investigators have produced estimation formulas to determine whether or not a given case is within the range of normal and tables have been compiled from these formulas. Probably the most commonly accepted formula is that of Hodges and Eyster. Estimation formulas are an attempt to obtain correction factors for heart size somewhat as Harris and Benedict have for basal metabolism.

Eyster states: "It has been found that the size of the heart in the normal subject depends in part at least upon three factors—height or stature, weight, and age—and attempts have been made to develop a prediction formula based on these three factors." He emphasizes the value of the area of the frontal plane of the heart and the greatest transverse diameter.

Bedford and Treadgold state: "We have tested Eyster's tables on our series of healthy subjects and they have given as successful a prediction of transverse diameter as we believe it is possible to make."

*Predicted Transverse Diameter by Hodges and Eyster's Formula.*—They state that this formula or equation can be translated as follows: "The probable normal cardiac transverse diameter of any male subject can be most accurately estimated by adding the products of 0.1094 times A, 0.8179 times W, subtracting from this sum the product of 0.1941 times height, and adding to the remainder the fixed figures of 95.8625."

They state further: "As a matter of fact, the efficiency of this formula is 19 per cent, which means that it is 19 per cent more efficient than assuming an average for all cases."

Hodges and Eyster give the formula for estimating the heart area as follows: "Predicted heart area in sq. cm. is equal to the measurement of age in years multiplied by the factor 0.0204, plus the measurement of stature in cm., multiplied by the factor 0.8668, plus the measurement of weight in kg., multiplied by the factor 0.337, minus the constant 63.8049."

Roesler gives other estimation formulas, and discusses in detail the various correlations covering: (1) Correlation between figures of cardiac silhouette, volume, and angulation; (2) Correlation of figures of cardiac silhouette and volume with certain body measurements; (3) Similar correlation figures for the lateral view.

Roesler states: "The only correct determination of heart size consists in the actual volumetric reconstruction. None of the formulas devised for computation of the heart volume guarantees a sufficiently small error. And only those can give approximately satisfactory results which consider three dimensions of the cardiac shadow."

Efforts have been made by various investigators to correlate the size of the heart with the transverse diameter of the chest, the height of the body, the body weight, the surface of the body, etc., and Lænnec and Cunningham compare the size of the heart to the size of the fist.

A method for clinical purposes must be simple and accurate and reproducible by different observers. There is a striking similarity in the shape of the silhouette of the heart and the lung-fields. If tracings of the heart silhouette are placed over the lung-field, with the base of the heart on the diaphragm and the apex pointed toward the apices of the lung-field, this becomes more noticeable. Similar figures can be compared by comparing their area or by comparing the product of the base by the altitude. The measurement of the broad diameter of the heart is less variable than the transverse diameter.

Because of the difficulty in accurately completing the upper and lower borders of the heart, which is necessary in determining the area of the heart silhouette, by either the planimetric method or the cross-section method, several investigators use the cardiac rectangle method.

Moritz states that the size of the heart can be figured out also from a rectangular figure formed by the longitudinal and trans-

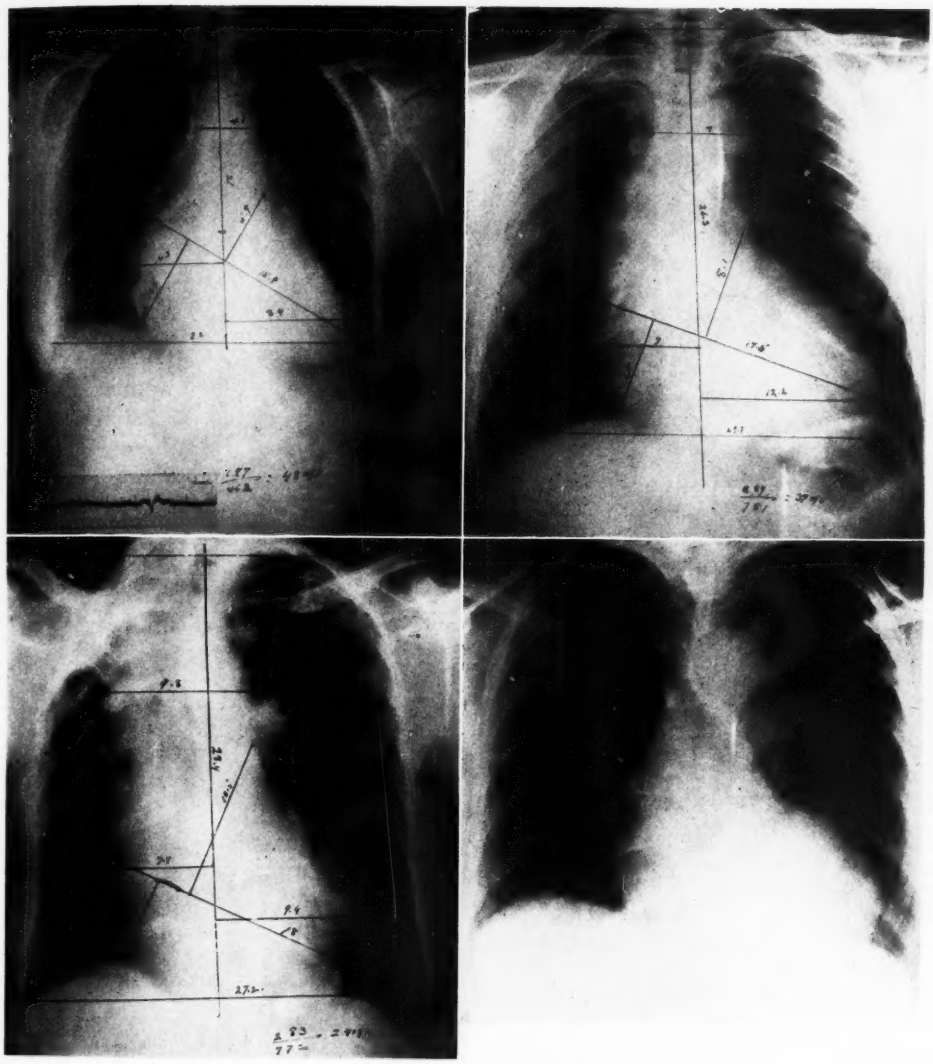

Fig. 14 (*upper left*). Myocarditis. $\frac{\text{Rectangle of the heart}}{\text{Rectangle of lung-field}} = 43$ per cent.

Fig. 15 (*upper right*). Aortic valvular disease. $\frac{\text{Rectangle of the heart}}{\text{Rectangle of lung-field}} = 37$ per cent. Systolic and diastolic murmurs over aortic valves. Corrigan's pulse. Note enlargement of the great vessels.

Fig. 16 (*lower left*). Enlargement of the heart associated with chronic tuberculosis of both lungs. $\frac{\text{Rectangle of the heart}}{\text{Rectangle of lung-field}} = 40$ per cent.

Fig. 17 (*lower right*). Shows an aneurysm of the aorta, outlined by a barium meal in the esophagus. Wassermann, plus 4.

verse diameters. He calls it the "cardiac rectangle."

Host uses the same cardiac rectangle as Moritz. He states that the orthodiagram is not supplemented by construction of upper and lower borders but a rectangular figure is constructed, the base of it being formed by the longitudinal diameter of the heart and the height by the width of the heart. Comparative measurements show

that the surface of such a rectangle corresponds to the actual surface.

Both Moritz and Host compare the area of the cardiac rectangle (using the transverse diameter) with the area of a rectangle formed by the largest transverse diameter of the thorax and the body height.

Roesler states: "There is a high correlation between length times the breadth and area (ratio equals 0.85), and it is, therefore, justifiable to use the length times breadth product (heart rectangle) instead of area." He uses the broad diameter in estimating the heart rectangle instead of the transverse diameter. This avoids the errors inherent in all transverse diameter measurements.

Consequently, in the method we advocate, the rectangle of the heart is obtained by multiplying the broad diameter of the heart by the long diameter. Instead of comparing the area of the cardiac rectangle to the area of the rectangle resulting from multiplying the width of the chest by the body height, as Moritz and Host advocate, we compare it to the rectangle of the lung-field.

To obtain the rectangle of the lung-field, a line is drawn at the base of the lung-field through the upper border of the left leaf of the diaphragm. Another longitudinal line is drawn tangent to the apices of the lung-field. A vertical line is drawn through the spinous processes or the midpoint between the heads of the clavicles intersecting the two horizontal lines. This coincides with the median diameter of the heart. The area of the rectangle of the lung-field may be arrived at by multiplying the length by the width.

For several years we have been interested in studying the ratio of the heart rectangle to that of the lung. We divided the heart rectangle by the lung rectangle and reduced it to a percentage basis.

We classified all hearts into asthenic, medium, and sthenic types and obtained the following results in normal cases:

Average of asthenic types—20 per cent—49 cases

Average of medium types—22 per cent—64 cases

Average of sthenic types—26 per cent—77 cases

Average of all types—23 per cent

We believe any heart going above 28 per cent is enlarged. The average for 53 cases going above 28 per cent was 35 per cent. We believe each heart should be compared with the average of its type and not with the average for all types.

The above figures were obtained in routine office work, including insurance examinations. The films were taken at six feet distance and one second time, at full inspiration. In drawing the line at the base of the lung-field, an effort was made to make allowance for the dome of the diaphragm in order to obtain the average depth of the lung-field. This is a mistake, as it allows too much chance of error as the result of the personal element. We believe more accurate tables can be compiled by drawing this line horizontally through the vault of the left leaf of the diaphragm. The film should be taken at full inspiration in order to more clearly outline the apex of the heart. Full inspiration may alter the transverse diameter of the heart considerably but has little effect on the broad diameter. This method compares the areas of two vital organs of the body, both of which are influenced by body build and body weight and have closely related functions in the body economy and vital activities. It eliminates the personal equation entering into the orthodiagraphic method and avoids any personal errors on the part of the examiner. The transverse diameter, which is the least reliable heart measurement, does not enter into it.

We wish to emphasize again the fact that each heart must be compared with its type—asthenic, medium, and sthenic.

## CONCLUSION

As a simple clinical method, we are advocating a teleroentgenographic method of comparing the heart rectangle to the

lung rectangle as $\frac{\text{heart rectangle}}{\text{lung rectangle}}$ reduced to a percentage basis, and have compiled a preliminary table in percentages for the asthenic, medium, and sthenic habitus, and urge that each heart should be compared to its type and not to the average for all types.

This method eliminates errors due to the personal equation as in the orthodiagraphic method, the hypothecation of the upper and lower borders of the heart in determining the area of the heart, and the use of the transverse diameter of the heart, which is the least dependable measurement we have. It gives one a permanent record which can be duplicated on the same person or by different operators.

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# PNEUMORADIOGRAPHY OF THE KNEE

## A NEWER TECHNIC DEMONSTRATING ITS VALUE IN THE DIAGNOSIS OF SEMILUNAR CARTILAGE INJURY

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THE futility of attempted diagnosis of lesions of soft parts lying within the knee joint has been reiterated too frequently to warrant further repetition. Narrowing or widening of the joint space on the impaired side has been frequently shown to be of no consistent diagnostic significance. The use of a contrast medium injected into the knee joint in order to emphasize the soft tissue shadows was apparently first performed by Werndorf and Robinson (30), in 1905, using air as the medium. Hoffa (13) recognized the possibilities of the method and commented upon it in 1905 and 1906. Martina (20), Querin (25), Grashey (11), and Weil and Loiseleur (29) were cognizant of the technic. Since 1920 many papers have been published demonstrating the diagnostic possibilities of pneumoradiography, particularly in meniscal lesions. In addition to air—filtered and atmospheric—oxygen, carbon dioxide, and many solutions opaque to x-rays have been used. The use of lipiodol, iopax, abrodil, perabrodil, tetra-iodo-ortho-sulphobenzoic acid and many other similar fluids has been reported.

Fig. 1. (*a*) Anteroposterior airgram of the right knee showing calcified medial and lateral menisci. The position of these cartilages should be compared with Figure 3.

(*b*) Lateromedial airgram of the same knee showing the calcified medial meniscus intact anteriorly and posteriorly.

(*c*) Mediolateral airgram of the same knee showing the calcified lateral meniscus intact anteriorly and posteriorly.

Pneumarthrosis has its opponents as well as proponents. Schoedel (27) lists as possible complications persistent synovitis, gas emboli, and sudden death. A rather thorough search of the literature on this subject has, to date, failed to reveal a case report of any of the above listed

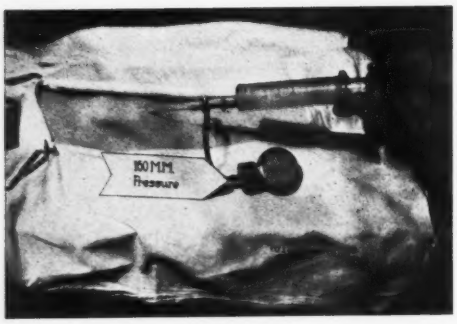


Fig. 2. The apparatus consists of a large syringe, a spinal manometer needle (B-D No. 3025) with a two-way cock and a sphygmomanometer. For consistent results the pressure should be 160 mm. Hg.

ing, and Oberholzer (23) reports over 1,200 cases from Bircher's clinic with no complications of any sort.

Almost as many different technics have been advanced as there are authors. The use of different gases and contrast media has already been commented upon. The site of puncture of the knee joint varies from just lateral to the patellar tendon upward to the supra-patellar pouch. The amount of the medium or media injected has been standardized by a few authors only. Different writers have recommended different planes for the x-ray views. Neither has there been more than a general

Fig. 3

Fig. 4

Fig. 3. Normal anteroposterior pneumoradiograph of the knee. The upper limit of the cartilage shadows is shown by the arrows.

Fig. 4. Normal lateromedial airgram of the same knee as shown in Figure 3. The upper and lower limits of the posterior portion of the medial semilunar cartilage are shown by the arrows. The anterior attachment of the meniscus is not well outlined.

potential sequelæ. Infection has been advanced as an unavoidable result in a certain percentage of cases with resulting pyoarthrosis and ankylosis. In our own series there has been no such untoward happen-

similarity in the post-injection care of the patient.

Our interest in the possibility of more exact diagnosis of meniscal lesions by pneumoradiography was stimulated by the

noticeable lack of correlation in "football knees" between the severity of trauma, the extent of semilunar cartilage damage, and clinical, roentgenographic, and operative findings could be correlated. These cases have been of particular interest, though the

Fig. 5

Fig. 6

Fig. 5. Normal mediolateral view of the same knee as shown in Figure 3. The anterior attachment (arrows No. 1) and the posterior extremity (arrows No. 2) of the lateral semilunar cartilage are outlined.

Fig. 6. Anteroposterior view of the right knee of a football player with an unstable joint. No locking was noted. The medial semilunar cartilage shadow is thinned. The upper limit is outlined by the arrows; for comparison, note the clear lateral semilunar cartilage shadow.

the clinical findings. The classical syndrome of a severe internal rotation injury of the knee, with the foot fixed, followed by joint instability, a movable tumor, noted subjectively or objectively, pain, and locking was characteristically absent at the onset. Following examination, the usual clinical diagnosis was that of a knee sprain. Only when the disability became chronic and the player was incapacitated for further competition did the true nature of the hidden damage become evident. As one of us (H. T. S.) has been consulting orthopedic surgeon for two of the larger university teams, we have seen, within the past two years or more, a relatively large number of "football knees" in which the actual number of pneumarthroses (about one hundred) is much greater.

The amount and tension of the air injected in our first few cases was variable, and it soon became apparent that the shadows cast on the x-ray films varied as well. The desirability of uniform plates is evident; therefore, it occurred to us that standardized air pressure would give constant shadows. Porter and Rucker (24), and Berg (2) seem to have been the first to employ a sphygmomanometer to measure the air pressure introduced into a joint; this was, however, for joint inflation in the treatment of joint inflammations, and not for diagnostic purposes. The former used a tension of 25 mm. Hg, while the

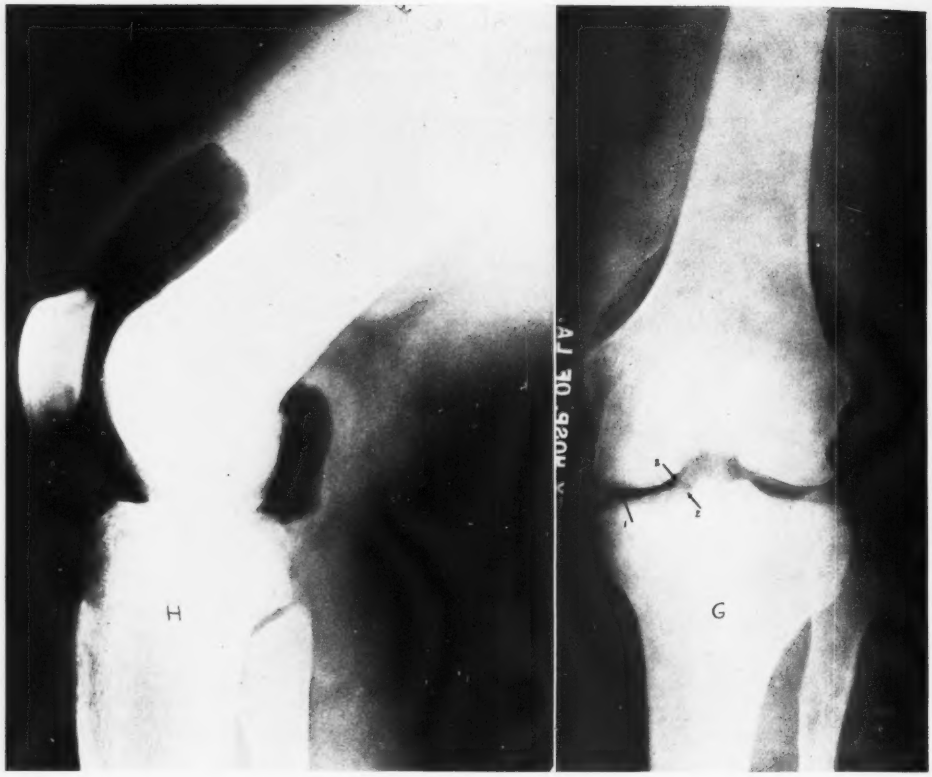


Fig. 7 Fig. 8

Fig. 7. Lateromedial view of the same knee as shown in Figure 6. The arrows show the anterior and downward "pouching" of the alar ligament, which normally (Fig. 5) continues from the lower patellar border to the upper tibia in a gentle, uninterrupted curve.

Fig. 8. Anteroposterior pneumoradiograph of the right knee of a football player who complained of knee instability. There was slight limitation of extension, but no locking. There is an air shadow separating the peripheral (arrow No. 1) and internal (arrows No. 2) portions of the medial meniscus. The diagnosis of a bucket-handle tear of the cartilage was confirmed at operation.

latter employed from 40 to 50 mm. Hg pressure. Bernstein and Arens (3) used 75 c.c. of carbon dioxide routinely in all joints for diagnostic purposes. Others have recommended distention to the point of discomfort. After considerable trial we found that a pressure of 160 mm. Hg (aneroid or mercury sphygmomanometer) inflated the joint uniformly, and that the soft tissues as seen in the x-ray films were comparable in density and position. By adhering to this routine, the matter of diagnosis has been, in our opinion, greatly simplified and improved.

Some earlier authors carried out the pneumarthrosis under rigid aseptic technic, performing the injection in the operating room. Others, no less successful in evading complications, carried out the procedure in the x-ray room, using ordinary antiseptics to sterilize the skin and employing sterilized instruments. As the latter method was the more simple, and as simplicity was desirable, we have used it, with no regrets. The use of radiopaque solutions, while apparently innocuous, did not seem justifiable since they admittedly have irritating properties.

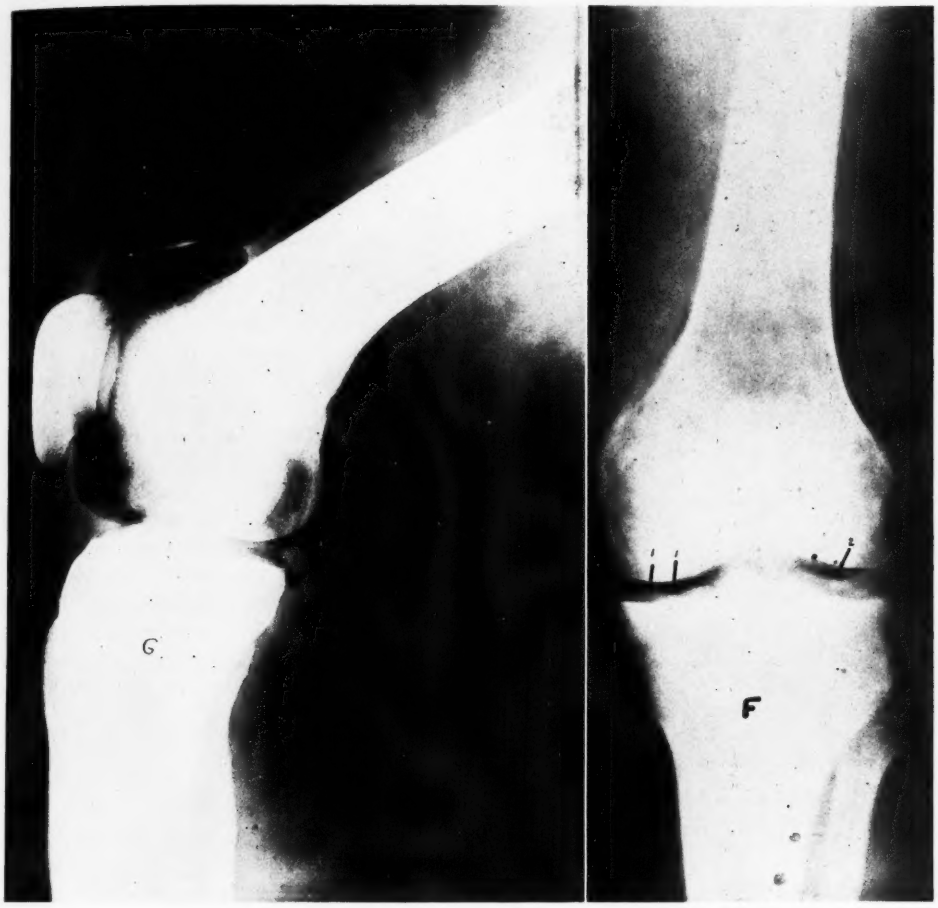


Fig. 9 Fig. 10

Fig. 9. Lateromedial pneumoradiograph of the same knee (Fig. 8). The arrow shows the partly torn and posteriorly displaced posterior portion of the medial meniscus. Anterior to it may be seen the displaced internal portion of the cartilage which lay in the intercondylar groove.

Fig. 10. Anteroposterior pneumoradiograph of the right knee of a football player. Arrows No. 1 outline the upper limits of a thinned medial semilunar cartilage. Arrow No. 2 demonstrates a tear of the lateral semilunar cartilage.

Another factor that caused some difficulty at the outset was infiltration of the pericapsular muscle planes with air, which occurred following injections by the lateral patellar route because of the high pressure. Since it was deemed advisable to withdraw the needle each time before the x-ray exposure was made, to prevent its shadow from causing diagnostic difficulties, we began following Kleinberg's (17) method of inserting the needle, *i.e.*, just lateral to the patellar tendon. While the knee joint is slightly more difficult to reach through the ligamentum mucosum, this structure acts as a check valve after withdrawal of the needle, preventing escape of the air into the intermuscular planes or subcutaneous tissues. There have been no ill effects apparent even in those cases which have been operated upon within 24 hours after the pneumarthrosis.

Following the taking of the radiograph, the greater portion of the air is allowed to escape. The remainder we have found to be absorbed within from 24 to 36 hours, confirming the observation of others. We

Fig. 11. Mediolateral pneumoradiograph of the same knee as shown in Figure 10. The arrows show the site of the lateral meniscal tear noted in the previous view.

have observed no sequelæ of any importance following pneumarthrosis. The "rattling" of the remaining air in the joint has been the most serious complaint by the patients.

Generally speaking, three views have been taken, an anteroposterior, a lateromedial, and a mediolateral. The anteroposterior view is taken preferably with the knee in about 20° flexion, the leg lying parallel to the table. The lateromedial and mediolateral views are taken with the knee in extension and the leg and thigh parallel to the table. Some postero-anterior views have been taken, but, unless extreme care is used, the film is valueless because of overlapping and confusing shadows. Oberholzer (23) has insisted on the value of oblique views; we have not used them but are convinced that in some cases the diagnosis, particularly of posterior third tears of the menisci, would have been made more apparent.

As has been frequently emphasized, air is the medium most readily available. We first employed it after filtering through sterile cotton; however, since there seemed to be no demonstrable difference between the joint reaction to filtered and unfiltered air the latter has since been our standard.

Our diagnostic criteria for the medial and lateral menisci have been the same save in one respect, *viz.*, when air underlies the cartilage. The attachment of the coronary ligament to the lateral cartilage is longer, and this meniscus is more mobile than the medial, which is the apparent explanation for the film of air that most frequently is seen beneath the normal lateral meniscus. Air underlying the medial meniscus has always been, in our experience, indicative of some type of pathology. Otherwise, the criteria for diagnosis of semilunar cartilage lesions may be listed as follows:

(1) Air outlining a torn or displaced portion of the cartilage.

(2) Posterior displacement of the posterior portion of the cartilage.

(3) Anterior displacement of the anterior portion of the cartilage. In many instances the anterior end is not visible and the tear is evidenced solely by an anterior and downward pouching of the alar ligament.

(4) An "air replacement" shadow which separates the peripheral and internal portions of the cartilage. This is diagnostic of "bucket handle" tears.

As Oberholzer (23) has emphasized, pneumoradiography is not infallible. Undoubtedly many small tears of the menisci are not diagnosed; however, these lesions would be treated conservatively in any event. Further, by its use, needless exploratory arthrotomies are avoided, while those that are necessary are performed before needless damage is sustained by the joint cartilage.

To date, 21 cases of traumatic knee injuries (of which all save four were sustained

in athletic sports) have been radiographed after air injection and subsequently operated upon. From these, 28 cartilages were removed. There were seven cases of both medial and lateral semilunar cartilage damage. In one case among the earlier, a diagnosis of damaged lateral cartilage was made but proved, at operation, to be Hoffa's disease. One other case, diagnosed as a double meniscal injury, showed severe medial but apparently no lateral cartilage damage when inspected from the medial incision. Of the cases operated upon, this represents a correct diagnosis of 92.9 per cent of the cases. This percentage may actually be higher, as the last mentioned case has not yet resumed full function.

## SUMMARY

A brief historical summary of pneumoradiography of the knee has been presented, together with a discussion of the indications and justification for its use, particularly in meniscal lesions. The diagnosis of lesions of other soft tissues within the knee is not commented upon, since our interest has been centered on traumatic damage to the semilunar cartilages, particularly those sustained in athletics. Our technic has been outlined and compared with that of other workers. The roentgen diagnosis of medial and lateral meniscus injuries has been discussed. The percentage of correct diagnoses in proportion to those cases proved at operation has been given.

## CONCLUSIONS

(1) A new method for obtaining standardized airgrams is presented, utilizing a uniform intra-articular pressure.

(2) Pneumoradiography is a certain aid in the diagnosis of obscure knee joint lesions of traumatic origin.

(3) Pneumarthrosis is an innocuous procedure when average precautions are used.

(4) In our series, at least 92.9 per cent of semilunar cartilage injuries were correctly diagnosed pre-operatively.

(5) Pneumoradiography will further reduce the number of exploratory arthrotomies.

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# ROENTGENOGRAPHIC DEMONSTRATION OF THE TRUE ARTICULAR SPACE

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IT is essential to realize that the articular space, as commonly referred to by most roentgenologists, is a misnomer, inasmuch as this designated space roentgenologically represents that portion of the joint which is relatively radiolucent, and corresponds to the distance between the osseous ends of the apposing surfaces. This comprises, in the diarthroses or freely movable articulations, the contiguous osseous surfaces covered by articular cartilage, and connected by ligaments lined with synovial membrane. This joint may be divided by an articular disc or meniscus, the periphery of which is continuous with the fibrous capsule, and its free surfaces likewise covered by synovial membrane. This potential space, intervening and enclosed by synovial membrane, is the true articular space; and changes in width, according to varying stress and strain. There is normally a slight amount of synovial fluid contained in this space, the presence of which probably tends to make the roentgenographic visualization of this space difficult.

Prior to the work of Dittmar (1), it had been erroneously considered that this true articular space was never roentgenologically demonstrable under normal conditions. Dittmar demonstrated this space without artificial filling, in the knee joints of children, and stated that this was occasionally noted in normal knee joints in children but never in adults, unless there was concomitant pathologic involvement. It is this latter statement which we wish to correct or modify, for we have been fortunate in demonstrating the true articular space in children, adolescents, and adults, in cases in which no history of trauma or disease was elicited. It is our conviction that, under optimum and coincidental conditions, this space is visible under normal conditions, with improved technic and if attention is focussed upon this phenomenon. To attest for the latter statement, since recognizing the first reported case of articular visualization, we were surprised at the number of cases presenting this appearance when particular stress was apportioned to this region, and search made for the entity.

In the main, we were unable to duplicate the excellent results in the visualization of the semilunar cartilage of the knee, as outlined by Dittmar, who recommends special technic. This consists of obtaining the ordinary anteroposterior projection of both knee joint regions and, additionally, with the knees in position of passively induced valgus. This method is of especial importance in examination of children's knees, inasmuch as a fair percentage present normally visualized articular spaces in the medial aspect of the articulations. Thus by comparing the two knee joints, one can determine the variance in size of the medially situated triangular shadow projecting into the space medio-laterally. This shadow is the medial semilunar cartilage cross-section viewed *in situ*, and any definable alteration of its normal shape can readily be noted. This type of examination should be performed in all cases of injury to the knee joint region that present suspicious signs and concomitant lateral amphiarthrotic mobility.

Unaware of Dittmar's original work, we independently noted this phenomenon of visualization of the true articular space in the shoulder of an adolescent. Inasmuch as this condition was considered never to be present normally and not visible by ordinary methods of examination, the roentgenograms were presented at a radiological conference. Every radiologist present unqualifiedly affirmed this assumption, and the question arose as to how gas entered the articular space, for none—among the number, some of wide experience—had ever visualized this space without the aid of air injection, etc. The paradoxical condition existed that the articular space

was visualized in the control roentgenogram of a normal joint. In retrospect, one might explain this appearance as being known. We are of the opinion that this space has heretofore been poorly outlined, and that, due to the vast improvement in

Fig. 1

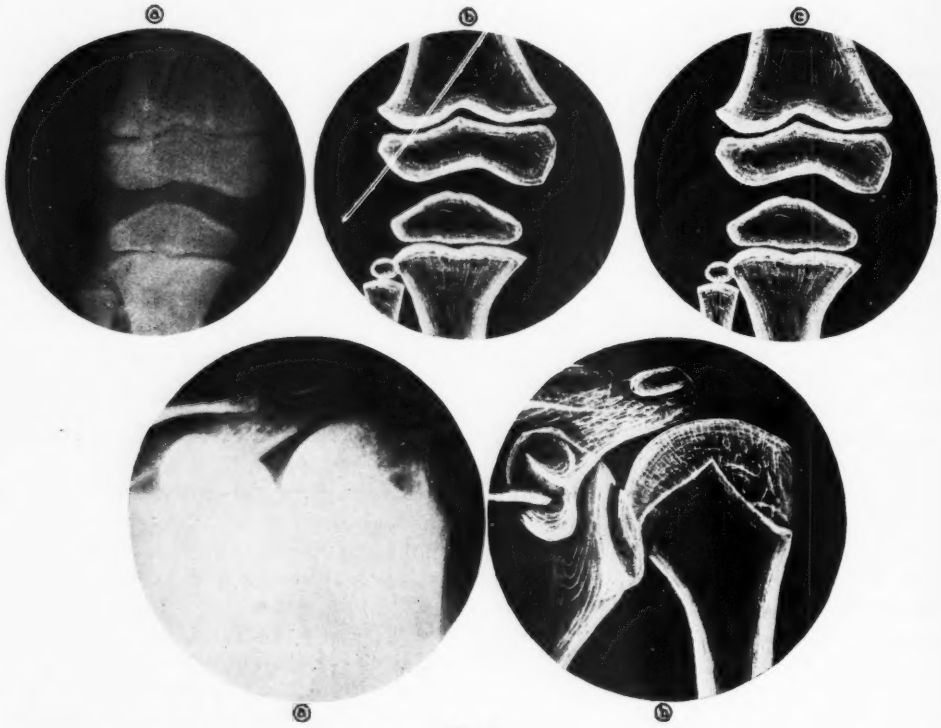

Fig. 2

Figs 1-*A*, 1-*B*, and 1-*C* (*above*). Fig. 1-*A*. Showing faint but definite outline of the medial portion of the true articular space.

Fig. 1-*B*. Diagrammatic sketch of the same region.

Fig. 1-*C*. The same knee, employing Dittmar's technic, of passively induced valgus. Note the increased width of the articular space, and the well-defined triangular indentation upon its medial-most aspect, which is a cross-sectional view of the medial semi-lunar cartilage.

Figs. 2-*A* and 2-*B* (*below*). *A*. Although faintly outlined, the crescentic outline of the articular space is definitely visualized. *B*. Tracing of the same roentgenogram, to illustrate the rather inordinate width of the space.

compatible with a lesser amount of synovial fluid and no periarticular edema or hemorrhage on the uninjured side, which permits of better visualization of soft tissue detail.

The question naturally arises, why this appearance had not been noted prior to Dittmar's and our own reports. It probably is true that this condition has been given no particular emphasis and was noticed, but not considered of any significance; or, more likely, its nature was not roentgenologic technic, particularly of extremely fine line focus tubes, we are actually observing more detail and minutiæ of both osseous and soft tissues than was possible, prior to the introduction of these modern methods.

To date, Dittmar's demonstration of medial semilunar cartilage disturbance, particularly in children's knees, is the only practical application described. As stated before, Dittmar claims that visualization of the true articular space never occurs in

normal adult articulations, but is always associated with pathology. Thus far we have disproven this assumption in two cases of shoulder joint visualizations, but not in the knee joints of adults; and therefore we concur in this statement only as regards the knee joint. It is very likely that this inference is incorrect, for it is readily conceivable that in the near future, this appearance will similarly be shown in the knee joint, as our attention is now drawn to this entity, and as more cases are under observation. Thus far, for patent reasons, we have been unable to find any practical application as regards visualization of the articular space of the shoulder joint, but it is of importance to know that this phenomenon can exist normally and therefore attach no pathologic import to the examination, when found.

For the sake of brevity, we are presenting three case reports of this phenomenon, in an adolescent shoulder joint, in a child's knee joint, and in an adult shoulder joint, from a group of these cases. We are unable to state the frequency of their visualization, because the number of cases is much too small for worth-while statistical survey. We are under the impression that in at least 10 to 20 per cent of children's knee joints will present this space, and probably no more than 5 per cent of adult shoulder joints. In practically every case, the articular space was outlined bilaterally in the knee joints of children; whereas contrariwise, none was amenable to roentgenographic demonstration bilaterally in the adult shoulder joints. This latter finding is probably due to the relatively few cases observed.

## CASE REPORTS

Case 1. A. S., a 17-year-old male, was injured in a football game and examined the same day. The provisional clinical diagnosis was possible fracture of the right clavicle. Roentgenographic examination disclosed no demonstrable evidence of fracture, subluxation, anomaly, or osseous pathologic changes about the bones comprising the right shoulder girdle. The left shoulder girdle presented essentially analogous findings except for visualization of the true articular space, which was approximately 2.0 cm. in length, and paralleling the convex apposing surface of the humeral articular head. It averaged 1.0 mm. in width. Close questioning relevant to any recent or antecedent injury, disease, etc., of this shoulder joint, elicited no positive information, and physical examination showed no evidence of anatomic or physiologic disturbance. (See Figs. 2-*A* and 2-*B*.)

Fig. 3. The dark fissure paralleling the humeral head border, is sharply defined, and of relatively narrow width.

Case 2. R. S., aged four years, male. The chief complaint was inability to extend the right leg due to pain in the knee joint. He presented a history of having fallen upon this knee, one week prior to the roentgenographic examination. The pain had become slightly but definitely increased in severity. Localized tenderness was elicited over the tibial tubercle. Roentgenographic examination of both knee joints revealed minimal, but definite, roughening of the tibial apophysis, left tibia, compatible with a diagnosis of early osteochondritis (tibial apophysitis of Osgood-Schlatter). There was no definable involvement of the articular space, but curiously both knee joints presented visualization of the medial half of the true

articular space of approximately equal clarity and width. An attempt at visualization of the medial semilunar cartilage was unsuccessful, possibly due to the attendant pain and involuntary spastic resistance. (See Figs. 1-*A* and 1-*B*.)

Case 3. W. R., male, 37 years of age. There was a history, essentially that of trauma by a falling ladder, against the lower right scapular region. No clinical signs of fracture were definable. Roentgenographic examination of the right shoulder joint was essentially negative with particular reference to fracture and subluxation. The opposite control shoulder presented no abnormal findings. As illustrated in Figure 3, there was excellent visualization of the articular space of the right shoulder joint, there being a crescentic dark fissure, of approximately 2.0 cm. in length and 0.5 mm. in width.

Other cases have been noted in the knee joints of children but presented no further additional diagnostic appearances or changes, than that described above. It is to be noted, that the roentgenograms were obtained, by three different technics; namely, non-screen, in children; screen technic in the adolescent shoulder, and a Potter-Bucky diaphragm in the adult shoulder. In the shoulder examinations, best results were obtained with the humerus in the position of rest, namely, mid-external and internal rotation. It is possible to mask the articular space visualization by excessive rotation of the humerus, and this might possibly account for the infrequent visualization, in the routine shoulder examination.

To date, we have been unsuccessful in visualizing the true articular space in other joints, and it seems strange that we have been unable to accomplish this, particularly in regards to the hip joint.

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# CONCURRENCE OF OSTEOGENIC SARCOMA IN TWO SISTERS

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IN February, 1936, two sisters, one 3 and one 11 years of age, were referred to the Department of Radiology with the diagnosis of osteogenic sarcoma for roentgen deep therapy following operation. A review of the literature revealed that, last year, Roberts and Roberts (2) were perhaps the first to report the occurrence of osteogenic sarcoma in three members (one brother and two sisters) of the same family. As these authors state, the development of sarcoma in successive generations (3) and in unioval twins has been described (1). Consequently, we thought that it would be of interest to record our observation in the literature.

Fig. 1. Fig. 2.

Fig. 1. Roentgenogram taken on Jan. 7, 1936.
Fig. 2. Roentgenogram taken on Jan. 16, 1936. (Both films were rather light and consequently do not show the pathology as clearly as Figure 3.)

Case 1. Be. R., X-ray No. 5,346, a 3-year-old white girl, was admitted to the orthopedic service (State of Wisconsin General Hospital) on Jan. 17, 1936, with a painful swelling just above the right knee. Three weeks before admission the child had fallen on the right knee and a week later became lame. Roentgenograms taken by the attending physician at home (Fig. 1) were interpreted then as osteomyelitis. This film, as well as another (Fig. 2), taken on Jan. 16, 1936, one day previous to admission to the hospital, shows mottling of the lower end of the femur with definite bone destruction, and an irregular laying down of new bone in the soft tissue. During the next two weeks the pain and swelling increased gradually.

Physical examination was negative except for the right leg; there was a hard, fusiform tumor mass at the lower end of the femur. The child had a flexion deformity of 20° at the knee, with a further range of 30°, which was painless. Roentgenograms of the knee showed both a destructive and a productive bone lesion in the lower end of the femur (Fig. 3). The tumor had invaded the soft tissue and there were areas of calcification in the invaded region. Roentgenograms of the

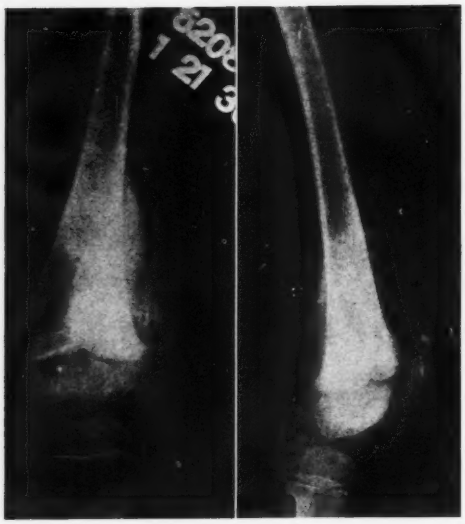

Fig. 3. Roentgenogram taken on Jan. 17, 1936. Mottling of the lower end of the femur with an area of bone destruction is present. There is marked periosteal reaction with new bone laid down irregularly in soft tissue.

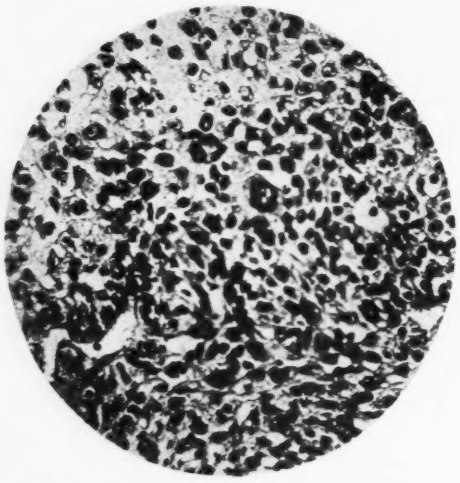

Fig. 4. Photomicrogram of No. 5346. The tumor is highly cellular, contains giant nuclei, highly anaplastic cartilaginous elements with mucoid matrix, and is very vascular. The structure of the tumor varies considerably; some sections contain giant spindle cells with abundant myxofibromatous stroma, whereas other sections are composed of closely packed large hyperchromatic nuclei and very little stroma. There are many atypical mitotic figures. One section contains considerable osteoid tissue and calcific deposits. Diagnosis: osteogenic sarcoma (osteolytic type).

Fig. 5. Roentgenogram taken Dec. 30, 1935. There is a destructive bone lesion of the lower two inches of the ulna, involving not only the lower shaft, but also the epiphyseal cartilage. Periosteal new bone formation is noted on the radial side of the ulna, with medullary destruction, soft tissue tumefaction, and invasion on the distal end of the ulna.

chest, skull, and long bones did not reveal any pathologic changes; laboratory findings were not significant.

Biopsy was done on Jan. 24, 1936; frozen sections showed an osteogenic sarcoma (Fig. 4). Amputation just below the hip was performed immediately; this was followed by a series of x-ray deep therapy treatments over the stump and right inguinal region from Feb. 12 to 21, 1936.

Case 2. Bl. R., X-ray No. 5,337, an 11-year-old white girl, the sister of Case 1, was admitted to the orthopedic service of the State of Wisconsin General Hospital on Jan. 11, 1936, with a history of a small swelling of one month's duration on the

ulnar side of the right wrist. It was painful only when bumped or touched firmly. The family physician had been consulted

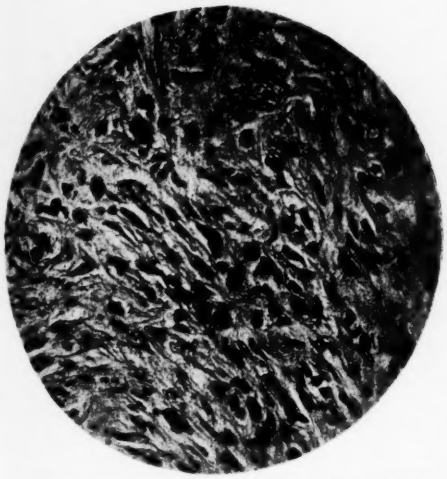

Fig. 6. Photomicrogram of No. 5337. This tumor is essentially similar to the previously described neoplasm; the sections show a highly malignant neoplasm. The tumor is very cellular and shows considerable nuclear pleomorphism and many mitotic figures. The nuclei vary considerably in size and shape—some are spindle-form, some ovoid, and a few are very large and irregular—and most of them contain large nucleoli. Some large nuclei contain as many as three nucleoli. There is quite an abundant fibrillar stroma, and in the less cellular areas the stroma is in the form of ribbon-like bands of collagen or hyaline material. The shapes of the cells are too numerous to describe; however, spindle-forms predominate; a few multinucleated giant cells are seen. Several islands of osteoid tissue and a few areas of so-called osteoid edema are encountered. A few of the less cellular areas suggest pre-osseous connective tissue. Some of the fragments contain areas of necrosis. Diagnosis: osteogenic sarcoma (osteolytic type).

two weeks after the onset. A roentgenogram was taken on Dec. 30, 1935, and a biopsy done on Jan. 12, 1936. The roentgenogram (Fig. 5) showed a destructive bone lesion of the lower 2 inches of the ulna, involving not only the lower shaft, but also the epiphyseal cartilage. Periosteal new bone formation was noted on the radial side of the ulna, with medullary destruction, soft tissue tumefaction, and invasion on the distal end of the ulna. The arm was placed in a cast and no increase in size of the swelling could be noted during the interval between onset of symptoms and admission to hospital.

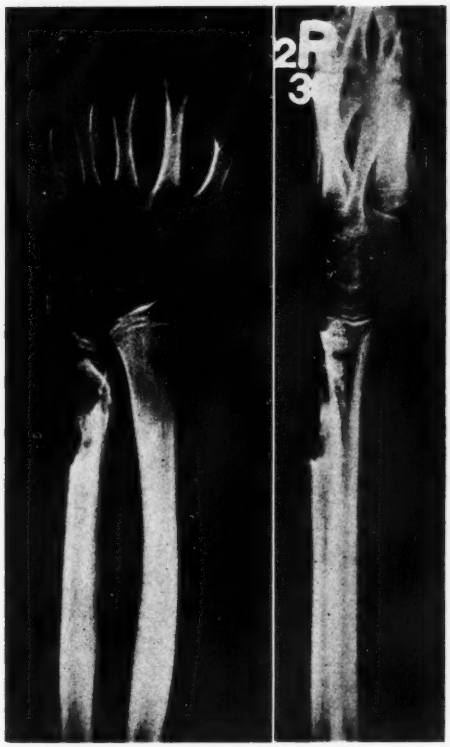


Fig. 7. Roentgenogram taken Jan. 13, 1936. There is a fracture of the lower end of the right ulna, with floating epiphysis; also, there is considerable bone atrophy of the carpus.

When the pathologist returned a diagnosis of highly malignant sarcoma (Fig. 6), the child was referred to the University Hospital.

Physical examination was negative except for the right forearm. There was a moderate, uniform swelling over the dorsum of the wrist and lower forearm. An incompletely healed incision over the lower end of the ulna was present and draining slightly.

Roentgenograms taken Jan. 13, 1936, showed a fracture of the lower end of the right ulna, with floating epiphysis, and considerable bone atrophy of the carpus (Fig. 7). Roentgenograms of the tibiæ showed deviation in contour of the right tibia at its proximal end. There was a slight bulging of the cortex, which appeared roughened in this area, but no definite

bone lesion was seen. Bone atrophy was present in both. Roentgenograms of other bones and the chest were negative. Laboratory findings were irrelevant. On Jan. 24, 1936, amputation of the right arm at mid-humerus was done. This was followed by a series of x-ray deep therapy treatments over the stump and right axilla from Feb. 7 to 18, 1936.

## COMMENT

We do not wish to deduce from this single observation any conclusions leading to a hypothesis or theory regarding the genetic origin of malignant tumors, or as to the rôle of any other factors which may be involved in the appearance of sarcoma in members of the same family of the same generation. It is the rarity of this occurrence which led us to publish our experience.

*Note:* Since the writing of this report, child Be. R. (Case 1) has developed metastasis in the right upper lung. (Roentgen examination of the chest on Sept. 28, 1936.)

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# COLOSPASM: ITS ROENTGEN DEMONSTRATION AND DIFFERENTIATION

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THE term "colospasm" should designate certain spastic manifestations of the colon which affect any of its segments. It is not a disease but merely a symptom which is undetectable except by its x-ray demonstration. "Colospasm" denotes only a roentgen diagnosis, regardless of any clinical correlation.

Similar x-ray findings have been described and correlated with "mucous colitis" (Crane) and found pathognomonic, although convincing proof is still lacking. "Mucous colitis" is synonymous with the "irritable colon" (Bargen), the "unstable colon" (Kantor), and the "mucous colopathy" (Barker), among many others listed by Barker and also by Crane. The proper understanding and interpretation of this relatively frequent roentgen sign is

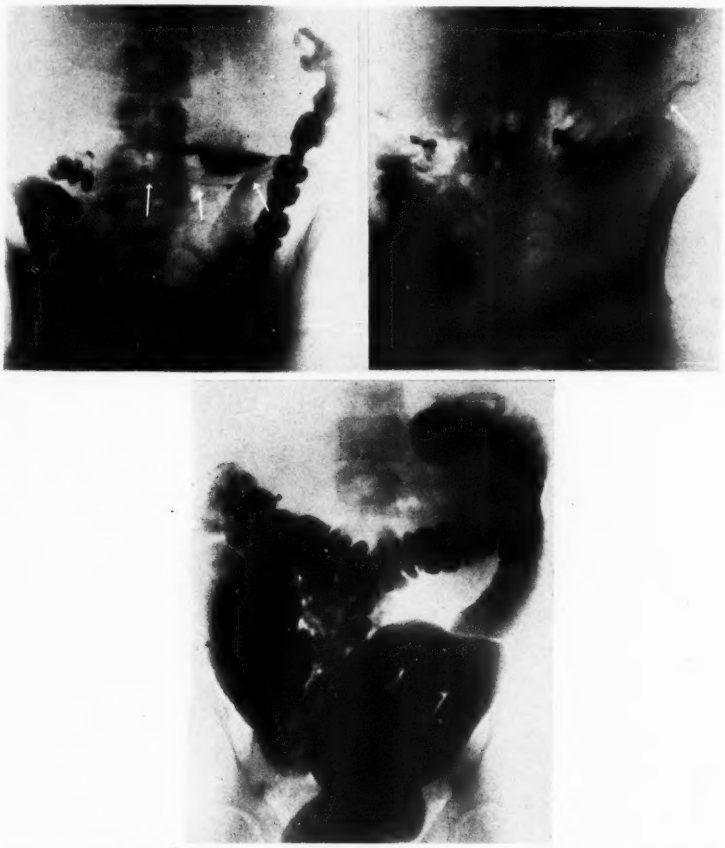

Fig. 1. The "colospasm," typical x-ray demonstration. (*A*) Note the thread-like, maximally contracted, spastic transverse colon throughout its length; (*B*) the filiform appearance; the maximal spasm is restricted to the distal portion of the transversum; in (*C*), after a barium enema, a completely normal (configuration, size) colon is visualized. Patient is a highly neurotic young female.

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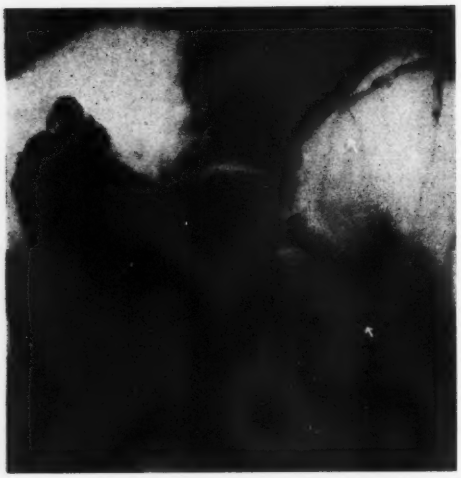


Fig. 2. Spasm of the transverse and descending colon. Note the sudden inception and termination of the spasm. Diagnosis: acute peptic ulcer, without neurotic components.

important and its differentiation should be stressed.

The literature on this topic is very meager and confusing. Crane, who first called attention to this x-ray sign, states that "it suffered a curious and extraordinary neglect at the hand of both the internist and roentgenologist." This must be true, in view of the fact that this x-ray sign has been described only as recently as 1927. In spite of this fact, and though in apparent contrast thereto, the disease itself is extremely frequent. Kantor emphasizes that the "unstable colon" is one of the most common and disabling diseases encountered in medical practice." This apparent contrast between the actual frequency of the disease and its erroneous classification and confused interpretation in the literature, as well as its neglected x-ray study, until late, is indeed quite striking. In the introduction of her writing on the "unstable colon," S. M. Jordan likewise refers to the state of "confusion which exists at present in the minds of most physicians in regard to the term 'irritable' or 'unstable colon' and its relationship to

Fig. 3.

Fig. 4.

Fig. 3. Spasm of the transverse and descending colon, with interpolation of a barium-filled segment of an egg-sized area on the descending colon. Note small 24-hour gastric residue. Diagnosis: double cancer of the stomach (operation). Patient is not neurotic.

Fig. 4. Spastic narrowing of the descending colon, in a highly neurotic male. Note the abrupt onset of the incomplete spasm.

Fig. 5.

Fig. 6.

Fig. 5. Spasm of the proximal third of the transverse colon. Note the sudden transition. The control film shows normal configuration. A neurotic patient, suffering from recurring duodenal ulcer.

Fig. 6. Spastic narrowing and segmented filling of the descending colon, over a circumscribed small area. The sudden onset, the curved shape and reduced width of the viscus resembles an appendix with a wide lumen. Diagnosis: chronic duodenal ulcer.

neurosis, etc." Crane emphasizes with inspired and polemical pathos the great confusion concerning this topic, the polypragmasia in reference to the clinical terminology, in contrast to the scarcity of intelligent description and confusing clinical interpretation of the disease, and still more so, the failure of its roentgenologic approach.

The loose, injudicious use of the term "colitis," in any connection relative to an actual or assumed functional abnormality, is so misleading, confusing, erroneous, and unscientific that the frank and straightforward suggestion of Sidney A. Portis, who emphatically recommends that "the word 'colitis' should be deleted from medical literature, unless there exists an actual organic involvement of the large bowel," should be met with general approval.

The contradiction and confusion are dramatically demonstrated by the fitting characterization of Crane: "notwithstanding centuries of extensive clinical observation, the present-day authorities show interesting differences of opinion and often

Fig. 7. Spasm of the distal portion of the transversum; its failure to fill its middle portion is possibly due to pressure from the spine. Note that this illustration is a reverse.

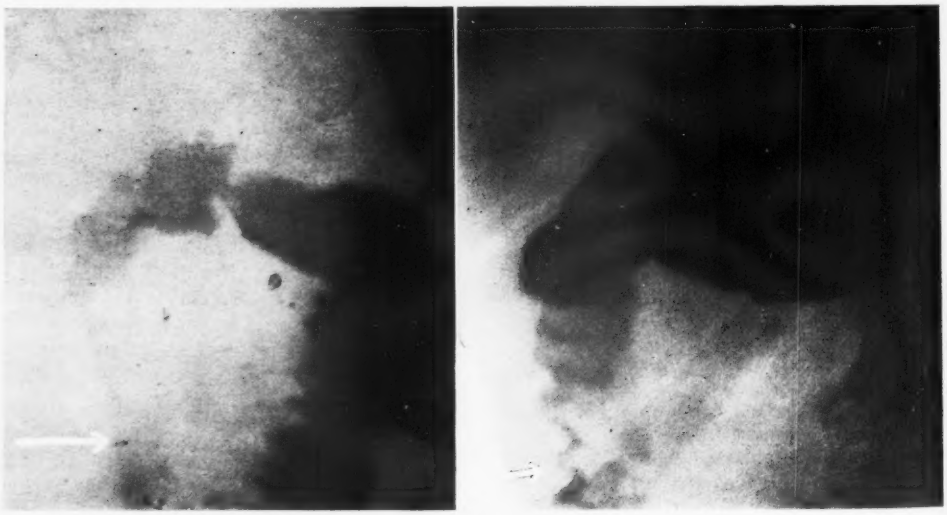
between-line evidence that the writers have had very limited personal experience with cases of this disease." In other words, a disease, generally known for a long time under various terms, in spite of this frequency was barely understood by the individual observer. The new names and synonyms applied tried to cover the ignorance underneath, but failed to clear the

Fig. 8. Spastic narrowing of a redundant mass of the descending colon over a circumscribed area, in sharp contrast to the wide lumen of the other part of the colon.

faulty conception. In spite of its frequency, Crane states: "In various other well-known works, medical, surgical, and diagnostic, mucous colitis is either not mentioned or else dealt with so briefly and in such general terms as to be without value."

Bargen, assailing the vagueness of the term "colitis," states: "When the term 'colitis' is applied only to infectious and inflammatory lesions of the large intestine, untold physical and mental anguish and suffering will be eliminated."

"Mucous colitis" or any of its variants, in spite of the fact that they are termed "colitis," is not a genuine colitis. In fact, such terms not only fail to signify a true inflammation of the colon, but they do not even represent a functional disease of it, because they are primarily parts of a general bodily state (Barker), the enteropathy being associated with a neuropathic constitution. Bargen sees the primary cause of a mucous colitis in the patient's make-up. According to Friedenwald, Feldman, and Rosenthal, the instability of the nervous system prepares the patient for the



*A* *B*

Fig. 9. Spasm in the duodenum. (*A*) The descending portion shows a linear spasm; (*B*) shows a corkscrewlike spasm. Patient, who is not of a nervous type, suffers from a duodenal ulcer, located at a higher segment.

condition. P. W. Brown equally condemns the use of the term "colitis," and similarly subordinates the same to a bodily condition. Hurst significantly states, in discussing the problem of "colitis" that, "No diagnosis is made more frequently and with less justification."

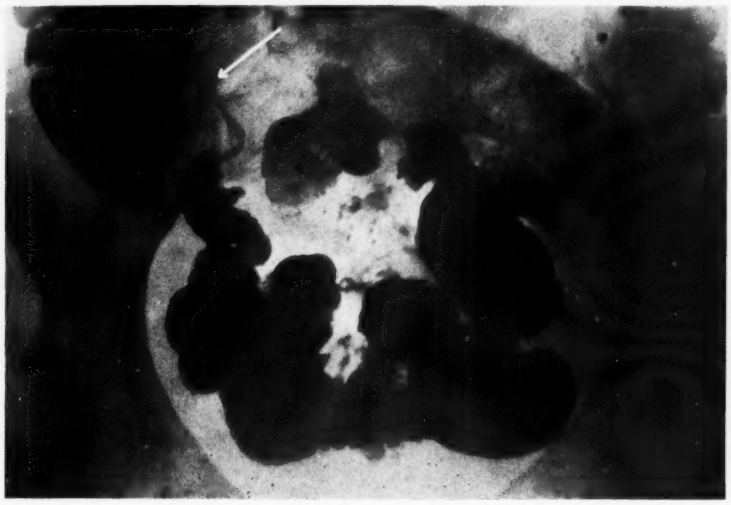


Fig. 10. Linear spasm of the terminal ileum. Control shows normal coil. Obscure abdominal pain, relieved by anti-malarial treatment.

The confusing and misleading facts and factors in this problem-complex, with a few suggestions for their correction, in my opinion, could be summed up as follows:

(*A*) "Mucous colitis" (colitis mucosa) and all of its variant names actually intend to be used for, and should be identified as "mucous colic" (colica mucosa).

(*B*) Colica mucosa is well known as the classical manifestation of the vagotonic condition. It is only one symptom, one localization of that general status, or bodily state, and in itself is not a disease *sui generis*, and should be so understood and correlated.

(*C*) The "string-sign" has nothing to do with "mucous colitis"; it is rather the x-ray demonstration of colica mucosa, but, while colica mucosa has the string-sign as its x-ray demonstration, the string-sign is by no means pathognomonic of this condition, as will be shown later.

(*D*) The string-sign is supposed to represent the maximal contraction of the colon of spastic origin. The term "colospasm" is, consequently, more suitable and descriptive for the spastically contracted colon. Any other maximally narrowed lumen of the colon or even of the small intestine, due to any cause, organic or inorganic, such as an extrinsic compression or an intrinsic encroachment upon the lumen by a tumor, granuloma etc., is or may be designated by the term of "string-sign," as applied by Kantor for the narrowed ileal coils in case of "terminal ileitis." "Colospasm" should not only designate a contracted, maximally narrowed lumen, but one caused by spasm only, excluding any organic origin. Colospasm is the term for a purely roentgen manifestation, not having any reference to the clinical side, cause, or interpretation of the case.

(*E*) Because all of the synonyms for "mucous colitis" are confusing, misleading, misrepresenting, and unnecessary, they should be discarded altogether.

(*F*) "Mucous colitis" proper, in suitable cases, could be better replaced by the term

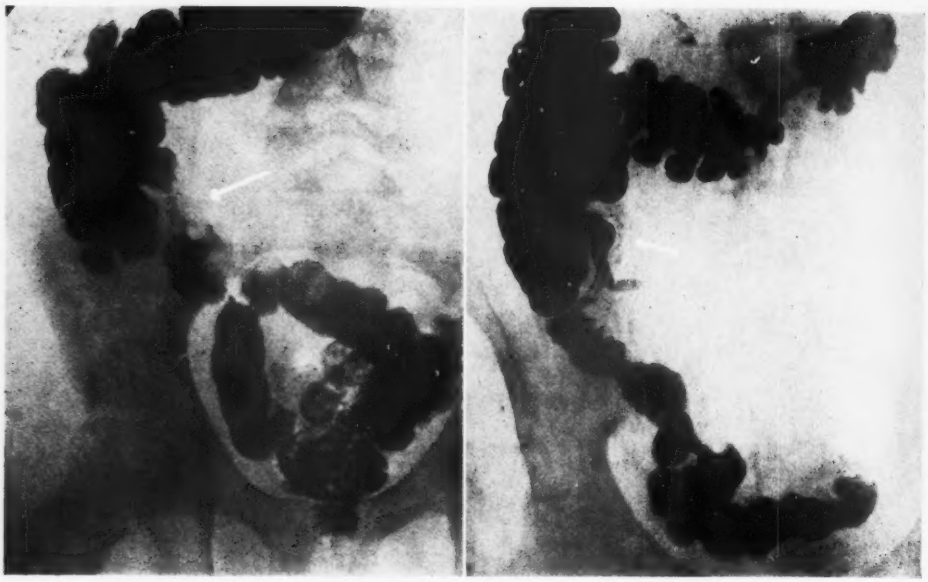


Fig. 11. Fig. 12.

Fig. 11. Spasm of the terminal ileum. Note the rugal outline. Incidental findings in a seemingly healthy boy.

Fig. 12. Spasm of the terminal ileum. Dotted appearance of the external outline. Note the crossing with the appendix. Simultaneous colonic spasms were noted. Diagnosis: duodenal ulcer.

"catarrhal colitis," which refers to the appropriate, mild cases of inflammation of the colon.

### THE CHARACTERISTIC FEATURES AND THE DIFFERENTIATION OF THE "COLOSPASM"

(1) The spastically contracted colon, in well-defined cases, produces a sharply outlined, straight or slightly irregular, very rarely spiral, linear marking, a long, thin "string" or thread of a hair-pin thickness, generally resembling a visualized lumen of an average, or still more appropriately, a narrow, atrophic appendicular lumen, the contraction, however, usually extending over a much greater length. In less pronounced cases the contracted lumen is thicker, heavier, and less characteristic; it may be interrupted, dotted, conical, or slightly feathery, but the latter is exceptional. Haustral markings and innerfolds are completely missed. The points of import, in reference to the more proper designation by "colospasm," as against the "string-sign," were discussed above.

(2) In rare cases, the contraction may affect any segment of the colon, or only the terminal portion of the ileum at its cecal juncture, or some part of the duodenum, and in extremely rare cases even the appendix. The location over either the transverse or the descending colon, or both, is most frequent. While the process extends as a rule over a larger stretch of the colon, generally a third or a fourth of its entire length is affected, at times, the spasm remaining restricted to a stretch of a few inches only.

(3) The spasm has a very definite shifting character, as a result of which a spastic contraction over the middle portion of the transversum may alternate, after a few hours, with a similar contraction over the descending colon, with or without a simultaneous disappearance of the former.

(4) The spastic contraction is never followed by a concomitant or compensatory reaction in the dynamics of the proximal portion, as is the case in cardiospasm or even in a long-continued pylorospasm

(a compensatory hypertrophy giving way later to a secondary dilation). Colospasm does not seriously interfere with the pass-

(5) The colospasm itself is always of good prognosis; it shifts, disappears, and causes no secondary changes. However,

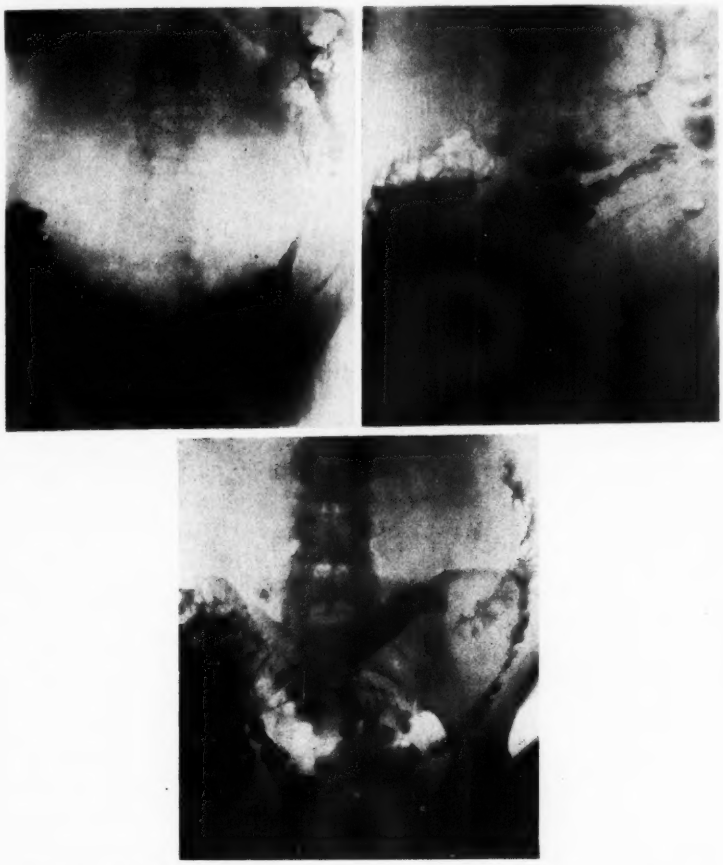


Fig. 13. Post-defecation film of the colon. Note in (*A*) the tapering start in the distal segment of the transversum; in (*B*), the sharply angulated course of the aboral portion of the transversum; in (*C*), the rather unusual pattern of the haustral markings. In all three films, after the evacuation of the bulk of the opaque material, some of the remnants visualize the mucosal rugal outlines, in a more or less complete fashion. Additional spastic or other functional factors may superimpose the picture, as in (*B*).

age and propulsion of the intestinal content, because, irrespective of the completeness of the tonic closure of the lumen, it is always of a temporary nature only. Consequently, the colospasm is not indicative of a permanent or fixed anatomic impairment, not even of a permanent functional derangement. In its presence, no typical, compensatory, nor consecutive changes of any nature are expected to follow.

it may co-exist with or accompany any primarily existing organic disease, tumor, etc., anywhere in the abdomen; consequently, while the colospasm as such is always of good prognosis, its presence, for the latter reason, still does not necessarily imply a good prognosis.

(6) The colonic spasm, as evidenced on films after the barium meals, disappears as soon as the opaque material is administered by rectal enema, proving that the

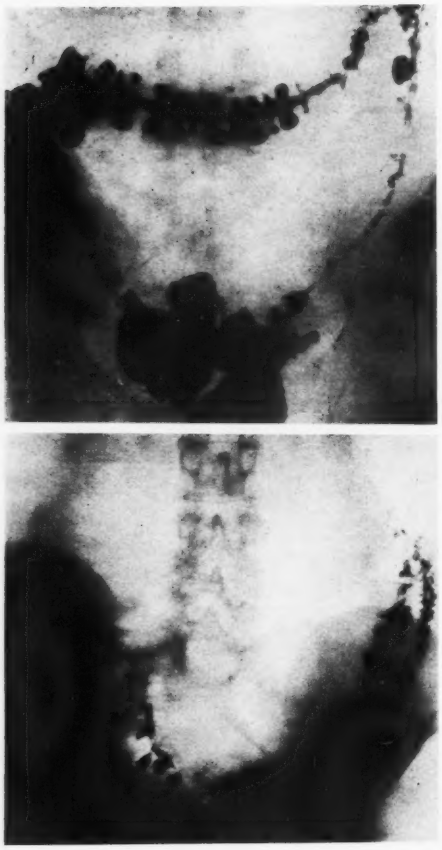


Fig. 14. Post-defecational films—various patterns.

direct cause for the narrowing of the lumen is not to be looked for in anatomic structural changes (stricture, compression, infiltration, encroachment, etc.).

(7) Spastic contractions over the colon are often associated with spasm encountered in other parts of the alimentary canal (esophagus, stomach, duodenum, ileum, appendix), or even over the gall bladder, proving that the spasm represents a generalized, systemic reaction of the individual.

(8) Colospasm may be considered as an expression or stigma of a neurogen or psychogen disposition; if the individual happens to suffer, among other things, from intestinal disorder, the syndrome-complex often but not necessarily is "colica mucosa." Colospasm may be present in the latter condition, but also in the absence of any vagotonic symptoms or even abdominal complaints, merely as a graphic demonstration, or a stigma of a psychoneurotic condition. Furthermore, colospasm is often demonstrated as an incidental finding, as a secondary accompaniment to any abdominal organic disease (such as cholelithiasis, appendicitis, peptic ulcer, carcinoma, etc.), with or without a neurotic base.

(9) "Mucous colitis" is identical with "catarrhal colitis," but with none of its synonyms. This condition, as its name indicates, designates an actual, though mild inflammation or a catarrhal condition, the catarrhal or the inflammatory product being "mucus." The term does not reflect upon the etiology, pathology, or even the clinical terminology of the underlying condition. Any inflammation or ulcerative process (dysentery, ulcerative colitis, tuberculosis, etc.) in its mildest form, or at its earliest stage, while the inflammatory product is only mucous (without blood, pus, or tissue débris), but only until such a stage, can be called "mucous" colitis.

The x-ray demonstration of the underlying condition reveals pictures different from the ones known for colospasm, or known as "string-like." Although the mildest form may approach the normal, its regular roentgen manifestation may present certain changes, especially in reference to the haustration. The latter may be lessened, smoothed, "ironed-out"; it may be irregularly shaped or spaced, or serrated (fibrillation), with an appearance recalling a jejunal shape. The shape may be described as mottled, spotted, marbled, beaded, ragged, shreddy, distorted, flecked, ribbon- or band-like, with a variance in the depths of the intrahaustral clefts, etc. The picture does not reach the typical, unhaustrated, sausage-shaped appearance of the non-specific ulcerative colitis. The differentiation from the maximally narrowed, spastic colon, the picture of "colica mucosa," should not occasion any difficulty. The case is clinically a colitis of a

*A* *B*

Fig. 15. Post-defecation film, in a highly neurotic individual. In (*A*), excepting the cecum and the rectosigmoid, the entire colon shows a silhouette of its rugal markings. In (*B*) the rugal outline of the rectum is visualized.

milder degree, as often encountered, developing after a long-continued abuse with cathartics. The mucus recovered in the feces elicits, microscopically, signs of true inflammation, with the presence of white blood cells ensheathed in the mucus.

(10) "Colica mucosa" (mucous colic) is a "neurosis with visceral manifestations" (Crane). Osler defines the true mucous colitis as "a secretion neurosis of the large intestine, met with particularly in nervous and hysterical patients." In Friedenwald, Feldman, and Rosenthal's characterization, "when the balance between the two sets of nerve fibers is interrupted, in that there is overstimulation of the parasympathetic system or inhibition of the sympathetic, secretion of mucus and painful spasm may occur."

Colica mucosa represents no inflammation, and the large amount of mucus detected in the feces shows no signs of any inflammation White blood cells are absent. "It is not catarrhal, although it is characterized by the discharge of large quantity of mucus" (Crane). The disease is primarily a neuropsychosis, the intestinal localization being of symptomatic significance only. In vagotonic conditions, sudden, painful abdominal attacks, with the discharge of large amounts of pure, glassy mucus, often giving a tubular innercast of a colonic segment, is the feature of the disease. The mucus can either be mixed with or only cover the fecal matter, or it can be ejected without any fecal admixture. It can be loose or tenacious, its water-suspension indicating its true shape and extent.

Its x-ray demonstration, as pointed out by Crane, in 1927 (he termed it "mucous colitis," but intended to designate "mucous colic"), is that of a "string" shape, morphologically identical with the authors' "colospasm." The "string-sign" is the x-ray manifestation of the "colica mucosa,"

Fig. 16. Fig. 17.

Fig. 16. Post-defecational film, as observed immediately after an *en masse* (Holzknecht) movement, after operation for terminal ileitis.

Fig. 17. Post-defecation film—an unusual pattern—with small irregular barium fragments nearly uniformly scattered throughout the colon. Case of terminal ileitis.

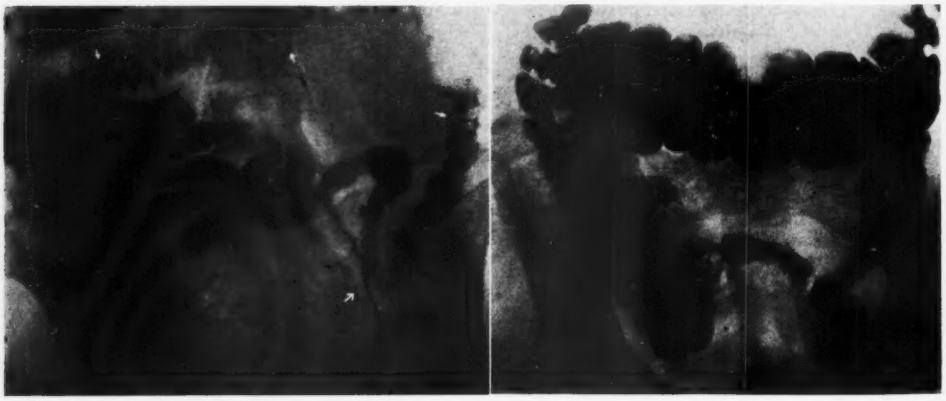


Fig. 18. Fig. 19.

Fig. 18. Post-defecation film in an individual with patent valves of Bauhin, after a barium enema. The barium-filled small intestines are uninfluenced by the defecational act; the colon is emptied, completely; the impregnation of the folds renders their visualization nearly as complete as seen after a routine folds-technic.

Fig. 19. Post-defecation film; unusual pattern of irregular haustration, in patient with constipation (cathartics habit). Note the tendency to spasm in the ascending colon. Partial evacuation after barium enema leaves the distal colon moderately filled, lending a "colitis-like" appearance. Control films show normal configuration of this segment.

although patients, especially neurotics, may manifest similar colonic pictures, even without colica mucosa.

The vagotonic, the maximally overactive colon, in its paroxysmal, colicky attack, assumes the shape of the overstimulated, maximally hypertonic or spastic colon, which is the customary roentgen manifestation of the clinical condition in question; nevertheless, the "colospasm" or the "string-like" colon is not pathognomonic of the mucous colic, because it may often be encountered without any counterpart in the clinical picture.

Exactly identical pictures are rather common findings, as secondary concomitant symptoms, in various abdominal organic lesions, in which the rôle of the nervous system is of little importance. I have occasionally found this colonic spasm in the presence of cancer of the stomach, peptic ulcer, cholelithiasis, appendicitis, etc., without clinical symptoms related to the colon.

*Conditions which Roentgenologically may Resemble "Colospasm."*—From the roentgen diagnostic point of view, the picture of colospasm should furthermore be differentiated from the empty colon, from the post-defecational picture, from the tumor-borne filling defect, from the roentgen demonstration of the ulcerative colitis, and from the picture of the failing filling between two barium columns.

(*A*) The picture of the empty colon, more correctly the segment void of opaque material, either because the barium has not entered it as yet or else because the barium has already passed it, is characterized by negative signs. The segment is not visualized. The transition into the barium-containing gut may be abrupt or gradual; in the shape of a conical or tapering picture, more so in the aboral portion in which the inspissated fecal matter shapes itself into a more plastic or solid mass. Any segment of the colon may prove to be empty or become so, but it is rather uncommon between two barium-filled columns; it is more frequent at either end of the visualized gut. A maximal spastic contraction, an organic or filling defect, producing complete obliteration of the lumen, may mislead in differentiation and

*A*

*B*

Fig. 20. Mild ulcerative colitis in a neurotic male. (*A, above*) rectal enema shows a circular, spastic ring in the ascending colon. The distal portion of the colon fails to show haustral markings. (*B, below*) under reduced pressure (administration of only one pint of barium emulsion), three spastic, circular contractions are visible in the distal colon, not demonstrated at the administration of the regular barium enema (three pints) under higher pressure.

interpretation of the borderline cases. Empty colon segments are often produced as a result of a compression in the prone position, due to the pressure of the spine.

(*B*) The post-defecational picture refers to the visualization of the terminal or dis-

Fig. 21.

Fig. 22.

Fig. 21. Ulcerative colitis. Note the irregular haustration of the transversum and the sausage-shape of the descending colon. Note its relative width, contrasting spasm.

Fig. 22. Cancer of the sigmoid in a young girl aged 20 years (operation). Irregular filling defect of circular shape, and of moderate extent and depth.

tal portion of the colon; it is not perfectly uniform. The rectum, sigmoid, and descending colon, rarely the transverse colon, after evacuation of the barium-containing feces, immediately or soon thereafter show certain characteristic features. The transition of the barium-filled colon transcends rather suddenly into the evacuated segment; the shape of the transition is more frequently tapering or conical than abrupt. The emptied segment usually shows barium remnants or streaks of its mucous foldings, in minute, feathery distribution; the picture often resembles the one obtained by using the fold technic. After the bulk of the barium mixture has left the lumen, some of its remnants impregnating the mucosal foldings will be retained there, resulting in a complete visualization of the mucosal foldings. The barium is rarely found in the shape of a solid mass or of a "string"; it is mostly loose, flocculent, feathery, infinitesimally minute, and retained in the folds of the mucous membrane. Diminished size, unhaustrated form, beaded or serrated shape, diffusely reduced barium content of the colon, lending the appearance of a barium "sprinkling" only, are by no means rare observations.

It may occur that, after a fractional or incomplete defecation, in spite of an extensive evacuation, nevertheless, some barium mass will remain in the rectum, and even in the sigmoid. The x-ray film should be interpreted in complete awareness of the history of the previous bowel movement. The differentiation, especially from the "colospasm" in rare instances, is hardly possible, and in such cases the knowledge of the last defecation is the *sine qua non* of the proper interpretation of the case. These findings should not mislead or counterprove the correct

reading and evaluation of the picture of the aboral colon segment.

*The Post-defecational Picture.*— It (1) refers to the previously barium-filled segment; (2) affects usually the terminal colonic portion; (3) is visualized only after defecation; (4) is, as a rule, not "string-like," as in spasm; not sausage-shaped, as in severe colitis (although it may resemble it after incomplete evacuation); is rarely completely void of barium remnants, as the empty colon is; is not irregular, "worm-eaten," short stretched, as in the case of tumors. Rather, it unfolds the picture of the mucosal foldings in minute, feathery appearance.

(*C*) Carcinoma or other malignant tumors, as well as various granulomas, encroaching upon the lumen of the gut, may produce a concentric or an eccentric narrowing. The area of the involvement is not extensive, its penetrating depth varies, and the visualized lumen is marked by an irregular outline (base and edge). The transition into the healthy tissue is a gradual one, rarely abrupt. The irregular filling defect is identical on all the films, regardless of the way in which the opaque material has been administered (rectal or oral), as one would find in anatomically fixed lesions. Development of a compensatory hypertrophy with a secondary dilation of the proximal portion completes the picture. The clinical aspect is that of a malignant tumor. The proper recognition and evaluation is all the more important, because carcinoma of the colon may simultaneously produce colonic spasm, and either of them may be multiplex.

(*D*) The picture produced by the ulcerative colitis is of an anatomically fixed shape, nearly identical on all the films. It affects the diseased area in its entirety, the changes being most severe, as a rule, in the distal portion. Its extent, affecting usually a large section of the aboral half of the colon, varies. The diseased area is, in the well-marked case, unhaustrated, rigid, pipe-like, or sausage-shaped, with a uniformly reduced diameter of the lumen, which, however, even in the most severe cases, does not even approach the thin and string-like appearance of the colospasm. The case clinically is that of a severe colitis.

Fig. 23. Filling defect, more precisely, a failure to fill, with irregular, though not ulcerated, outline of the barium shadow, due to failure of filling of the segment, after two successive barium intakes (24 and 6 hours, respectively).

(*E*) Very rarely an interesting, in fact, a puzzling, filling defect of the colon may be encountered. In reality, it is not a "filling defect"; it is rather a "failing filling" of a certain segment of the colon, due to conditions created by two successive barium meals, several hours apart, when the head of the second filling had not as yet reached the tail of the first filling, leaving a short stretched segment of the colon unfilled. The picture can be further obscured or rendered misleading by the discovery of some small barium remnants or flecks, harbored in the folds or in the lumen of this unfilled area. The unusual morphologic appearance may give rise to differential diagnostic difficulties, especially in the way of excluding spasm or tumor-produced filling defect. The knowledge of this fact (the mere awareness of its existence), the lack of any pathology in the

clinical picture, and furthermore, the change, the advance, and the eventual refilling, resulting in complete disappearance of this peculiar filling defect (provided that successive films are taken at considerable time intervals), clears the situation.

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# HISTORADIOGRAPHY

## A NEW APPLICATION OF X-RAYS

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IN RADIOLOGIC routine, natural or artificial differences of density must exist in order to obtain shadows which can be interpreted. In operating in the usual way, under 50 kv. potential, rarely is one able to differentiate tissues which are of nearly the same density. Also, the grain of extremely rapid x-ray films is always very large and can hardly support enlargement. The thickness of the tissues examined is such that diffused rays play an important rôle.

When the object to be examined is thin and non-dense, it is necessary to lower the voltage, *i.e.*, to lessen the mean wave length of the x-ray beam; which at once gives rise to difficulties.

Goby (1913–1925) presented, before L' Académie des Sciences, radiographs of small objects and insects taken with soft rays. His work, although of interest, did not bring about any change in the usual technic of x-rays. Under atmospheric pressure, absorption phenomena prevented Goby from making use of the advantages which many soft rays afford in differentiating bodies of neighboring densities. The diffusion of the air played an important rôle and, on the other hand, enlargements could scarcely exceed one-tenth of some diameters.

It was of interest to try to take radiographs of more delicate structures than those studied by Goby. In 1930, Dauvilliers presented a note on radiomicrophotography. He was the first to utilize grainless photographic plates; the negative thus obtained could be greatly enlarged. Using very soft rays he obtained interesting contrasts at a potential of from 7 to 9 kv. To avoid air absorption, the plate and preparation were placed in a special camera through which a current of hydrogen was passed.

It seems interesting to us to recall briefly Dauvilliers' technic, which we have modified slightly. He used a tube which he had made for crystal analysis. It consisted of a metallic body for the anode with an interchangeable target bearing four diaphragms of variable diameters, shut off by aluminium windows which could be attached to hermetically sealed cameras bearing the photographic plates. These cameras were emptied or filled with hydrogen. A pin

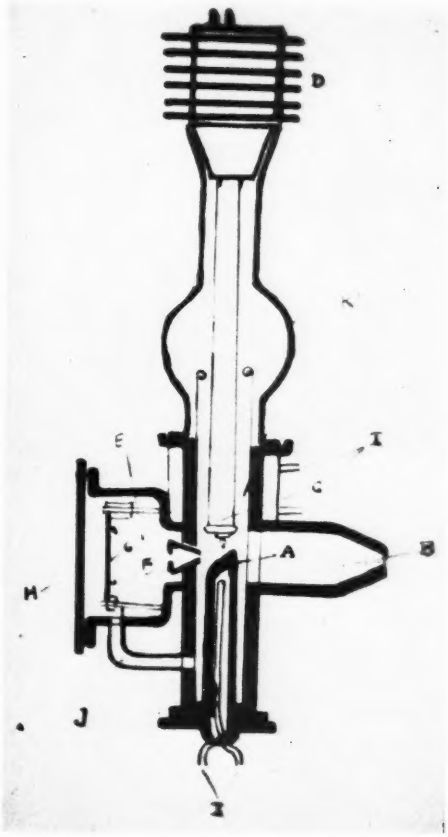
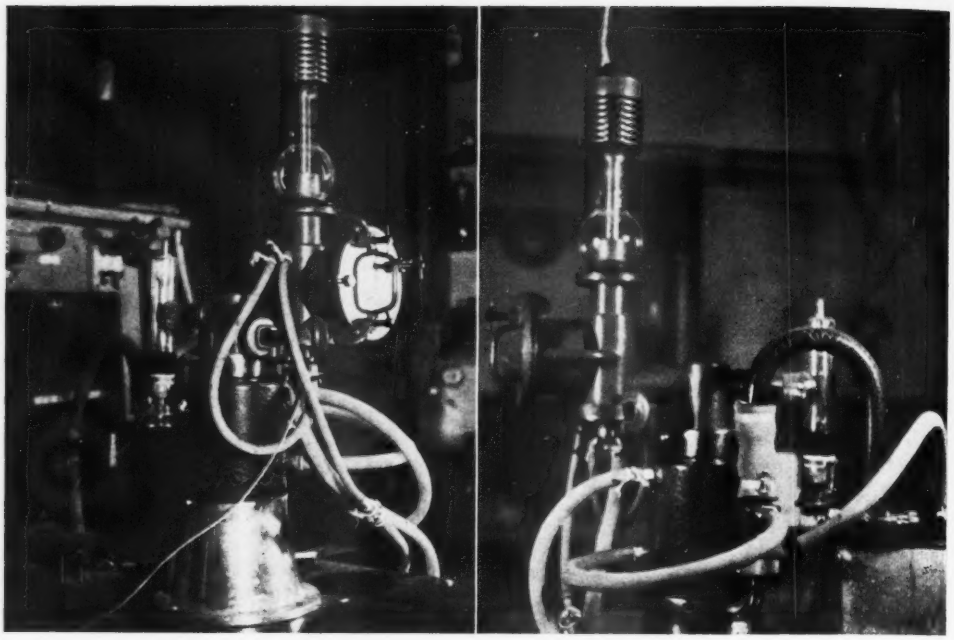



Fig. 1. Scheme of the tube. (A) Target, (B) To the vacuum pump; (C) Cathode; (D) Air radiator of cathode; (E) Camera; (F) Window with aluminum filter; (G) Photographic plate; (I) Water cooling



Figs. 2 and 3. The x-ray tube mounted on the oil diffusion pump.

hole central focus was obtained by means of a Coolidge cathode.

The vacuum in the tube was maintained during the manipulations by an oil diffusion vapor pump. The potential applied varied between 7 and 8 kv., with a tungsten target and a current of 0.1 ampere; the time of exposure did not exceed two hours. The plates were reinforced with silver in order to obtain photographic densities which would support greater enlargements.

The preparation is applied directly to the emulsion with a drop of alcohol. After exposure the preparation is removed and the plate is developed and examined under a microscope.

By this method Dauvilliers obtained a fine radiomicrograph of the pith of elder, in which intercellular separations belonging to the microscopic skeleton are perfectly discernible.

*Personal Technic.*—Interested by Dauvilliers' work and taking into account all the results which might be useful in microscopic work, we have, since 1931, studied this technic and have ascertained that while it was relatively easy to radiograph botanical sections, it was certainly more difficult to obtain the same results with animal tissues. From the beginning we have been handicapped by practical difficulties, chiefly in the production of plates and sensitive emulsions which do not exist in commerce; the results obtained are not always those desired, and they are not constant. It is difficult to obtain, in a laboratory which does not specialize, a satisfactory homogeneity of the sensitive layer, a good adherence of the gelatine, and above all, a regular and sufficient sensitiveness. The latter is greatly diminished—about one-thousandth of that of ordinary commercial plates, even the least rapid.

It was this lack of sensitiveness and inconsistence in the results obtained which led us to several modifications in the apparatus. First, we tried to bring the preparation nearer to the target, but the small apertures of the tube had to be enlarged to allow the x-ray beam to spread over a suffi-

cient surface. The enlargement of the diameters of the apertures was not consistent with their resistance. The vacuum system caused vibrations which frequently burst the windows, the latter being necessarily very thin. To overcome this, we have made a special camera which is hermetically sealed to the tube, the axis of which is perpendicular to the axis of the camera. A vacuum is obtained in it by means of the vacuum system used for the tube. This method, however, presented difficulties, and we have been obliged to make a new tube, which will be described later on. The cathode light is screened off from the plate. Different filters have been tried: very thin

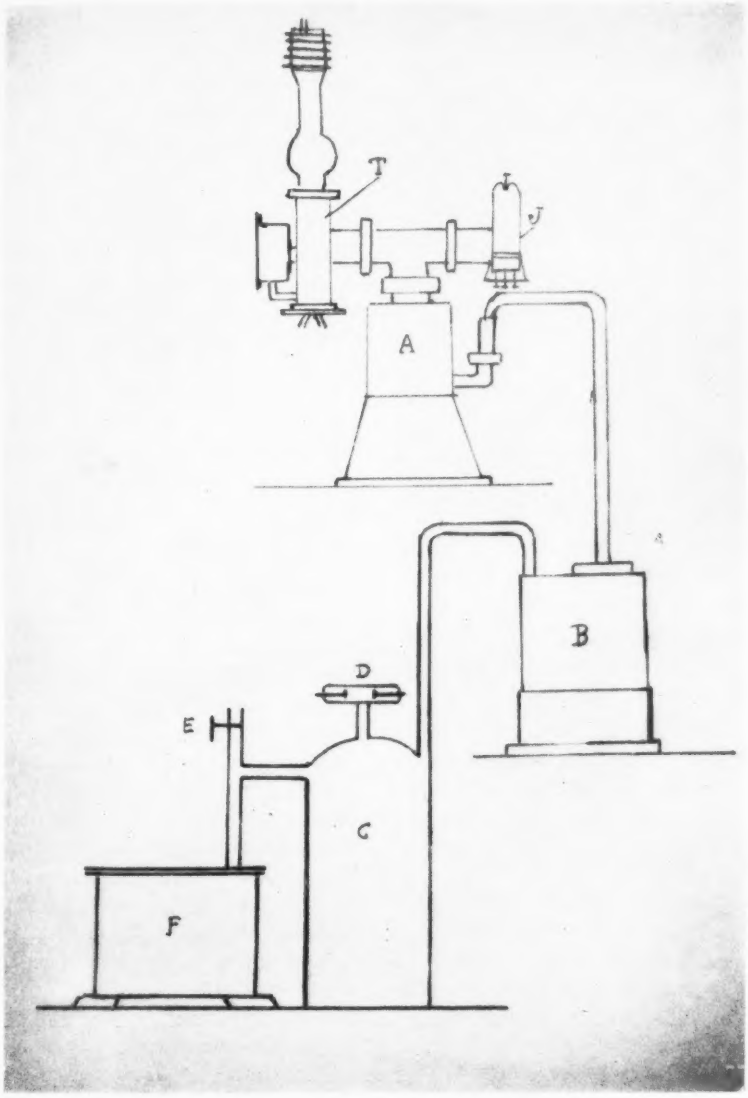



Fig. 4. Pumping system. (T) Tube; (A) Oil diffusion pump; (B) Mercury diffusion pump; (C) Tank for primary vacuum; (D) Air gauge; (F) Rotating oil pump; (J) Thermionic gauge; (T) X-ray tube.

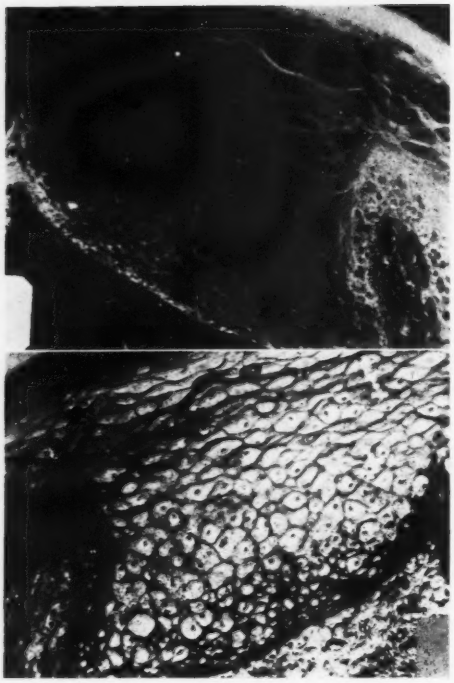


Fig. 5 (*above*). Historadiograph of epidermical section; negative picture, as observed, is directly under microscope.

Fig. 6 (*below*). The same historadiograph but as a positive picture.

leaves of aluminium (which we still employ) present many inconveniences, *e.g.*, frequent perforations in the course of rolling, and the utilization of cellophane was unsuccessful. The use of lithium windows (atomic number 3) is also to be tested.

The tube which we have made is of metal, with a water-cooled tungsten target; the air-cooled cathode is supported by a glass cylinder similar to Dauvilliers'. The difference consists of a cylindrical camera soldered to the body of the tube and hermetically closed behind, by a metallic disc, to avoid fluctuations during pumping, and the consecutive perforation of the filter. A large communication unites the camera and the body of the tube, the latter being mounted on an oil vapor diffusion pump.

The necessary vacuum is obtained about thirty minutes after starting, due to the high speed of exhaustion. The pumping stability is perfect, a special security system cutting the current when the water fails.

The target of the tube is grounded. The exposure does not exceed 5 minutes with 5 kv. potential and 80 ma. intensity.

After exposure, the pumps are cooled for 30 minutes, and after admitting air, the camera is opened. The plate is developed with the "section" adhering to it. During the development it is generally easy to detach the section by rubbing it lightly. If it is thin enough, the section can be left adhering to the plate, as it does not hinder the examination of the image. It is sometimes difficult or even impossible to "unstick" it.

The window diaphragm of the camera has been specially studied with regard to the focal surface and distance of the preparation. The area, which when exposed corresponds to a circle of one centimeter diameter, is generally sufficient to cover all the section.

When the plate is dry, it is possible to examine it microscopically as if it were a histologic preparation.

*The Photographic Plates.*—We make the plates ourselves, having tried numerous kinds; nearly all of them have annoying grains, even those sold as having none. The plates are made by Lippmann's technic for interferential photography, which is essentially delicate for small plates. We have made real progress by using celluloid supports which are easier to manipulate. The Gevaert Film Company, of Belgium, furnishes us with a special Lippmann film which gives great satisfaction.

The use of a film allows us to place the negative, after exposure, between two glass plates joined by Canada balsam, as in histologic preparations.

*Advantages of the Method.*—Thanks to our method, we have been able to obtain radiographs of sections of animal tissues. We believe we are the first to accomplish this, Dauvilliers having worked on botanical sections only. The result has been made possible by very good emulsions and celluloid carriers, and above all by using a much softer x-ray beam (5 kv.). As perfect a vacuum as possible is maintained in the

camera and there are practically no scattered radiations or absorption by gases. We have been able to reduce the time exposure considerably, from 2 hours (Dauvilliers) to 5 minutes. At the beginning of the research, exposures of 20 hours or more were necessary.

## RESULTS

The radiographic images thus obtained are sharp and clear. We foresee the possibility of much further progress with better vacuum conditions which demand some practice; it is necessary to use only a thin section and to have a perfect adherence between the section and the plate.

The image thus obtained is a negative one, and this presents the greatest obstacle to the histologist who examines it. The parts which are normally light on the colored preparation are often dark on the plate, and *vice versa*. This particularity necessitates a re-education of the eye, which we are persuaded can be quickly accomplished. In the difficult cases it is easy to obtain positive images by photomicrographs which are much simpler to interpret.

We have called the images thus obtained historadiographs, a name which exactly describes the classic microscopic structures, except for rare exceptions, and with some training, will be interpretable.

However, some new unforeseen aspects have been encountered in colored methods. Even with very thin sections considerable variation in opacity exists, some cellular structures absorbing x-rays more than others.

We cannot quote all the tissues examined, but taking human skin as an example, it is possible to state differences of absorption with regard to the various parts of the epidermic layer.

Peripheric cells of the horny layer are extremely opaque and with increasing depth the opacity gradually *lessens*, to arrive at a maximum at the level of the basal cells. This final opacity may be due to the pigmentation, but we do not agree with this supposition for in the historadiographs of melanic tumors we do not observe any particular opacity of pigmentation cells to x-rays. Intercellular spaces may be seen with unbelievable richness in the Malpighi layer. Cytoplasm is granular and relatively opaque in regard to the nucleus, which is completely transparent. A highly opaque spot exists on the nucleus —the nucleolus. It is probable that the

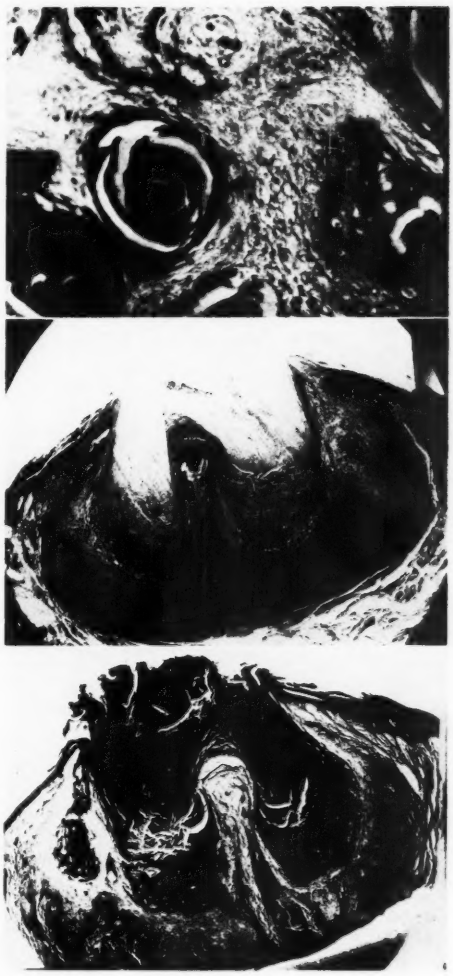


Fig. 7 (*top*) Epidermical cancer—remark opacity of epidermical globe.
Fig. 8 (*middle*). Photomicrograph of an ordinary stained section of a lip papilloma.
Fig. 9 (*bottom*). Historadiograph of the same section. Notice the opacity of keratinous layer.

substances of greater density found in the cell are condensed in this area.

If we enter into the pathologic examination of the tissue, we shall see, for example, that keratinous cells of epidermic globes have a remarkable opacity and are much easier to discern than by any other method.

Several other phenomena have been observed which will be explained in collaboration with histologists.

## CONCLUSIONS

The method enlarges the domain of medical histology. We believe that we are presenting here a new technic which will complete the coloration ones. We have great hopes in its future, for it introduces new elements in the physical and chemical nature of cellular constituents. Absorption zones correspond to regions of small atomic weight, and *vice versa*. As Dauvilliers has already emphasized, with very soft x-rays oxygen will be more absorbant than carbon, for example, and any trace of sulphur in the preparation will suffice to render it opaque.

This new process will make possible information on the density of cellular constituents. With the aid of a new chemical agent it will be easy to render opaque a particular cellular region and to study it better, as color does not play a part here; the range of useful agents being greater and at the same time the technic being much more simple, the field of histochemistry will be enlarged.

It will be equally possible by this new method to recognize foreign substances introduced into the tissues, particularly the slight penetration by medicaments.

Methods of identification will find in this method a new and solid base.

## SUMMARY

A new method to obtain radiographs of microscopic sections by use of very soft x-rays is presented; it is carried out *in vacuo*. Special photographic emulsions are utilized which allow greater enlargements. The images obtained, which are examined microscopically, have already shown special new aspects which will be of great importance in histologic examinations.

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# THE BIOLOGICAL MEASUREMENT OF GAMMA RAYS IN "EQUIVALENT ROENTGENS"

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DURING the past decade a number of attempts have been made to unify the methods of measuring x-rays and gamma rays. Since both types of radiation are used extensively in cancer therapy, it is important to be able to express their dosages in a common unit. Even while the unification work has been going on, the range of wave lengths available in the therapeutic portion of the electromagnetic spectrum has been greatly expanded, thus making unification still more important.

Since the international unit, the roentgen, has been satisfactory for measuring x-rays, it is natural that attempts should have been made to measure gamma rays in the same unit. Theoretically, this should be possible and the roentgen has been employed as the unit quantity of radiation in practically all unification attempts.

In general, two methods of measuring x-rays and gamma rays in the same unit have been employed. The first is direct and involves a procedure carried out in accordance with restrictions imposed by the definition of the roentgen.[1] The second is indirect and is carried out by comparing gamma-ray doses required to produce an effect on a test object, living or non-living, with x-ray doses of known roentgen value required to produce the same effect. In such a case, the gamma-ray dose is not expressed in roentgens, as such, but in what has aptly been called "equivalent roentgens" (Failla, 1933). An equivalent roentgen may be defined for gamma-ray work as the quantity of gamma rays which will produce the same effect as one roentgen of x-rays, x-rays produced at voltages around 200 kv. being implied. Hence, while the equivalent roentgen value is dependent upon the response of the test object being used and may vary, it has been hoped that some general agreement would be found among the values obtained with the various test objects and thus provide a means of measuring the two radiations in a common unit.

We shall employ the expression *roentgens of gamma rays* in this report, but it is always to be understood that equivalent roentgens are meant unless otherwise stated.

The direct method of measurement would undoubtedly be superior, providing satisfactory measurements could be made, but almost insurmountable difficulties have been encountered. Hence, both methods have been used and already the literature has commenced to accumulate (Table I). By examining Table I, it will be seen that the results are quite discordant.

With the accumulation of data on this subject, there has been a tendency on the part of the recent writers to adopt a set of standard conditions for measuring and expressing gamma-ray intensities in order that results obtained by various investigators may be compared. For this purpose, 1 cm. distance from a point source and a filter of 0.5 mm. of platinum have been used. Since these specifications have been satisfactory, we, likewise, will employ them and refer to them as standard conditions. The unit distance of 1 cm. was adopted mainly because it satisfactorily combines convenience of manipulation and radiation economy, and the filter of 0.5 mm. of platinum because it cuts out practically all of

[1] The roentgen, as defined by the International Congress of Radiology, in 1928, may be given as follows: The unit of dose is that quantity of roentgen radiation which, when all of the secondary electrons are utilized and the wall effect of the chamber avoided, produces in 1 c.c. of atmospheric air at 0° C. and 760 mm. mercury pressure such a degree of conductivity that one electrostatic unit of charge is measured under saturation conditions. (See Reference 15.)

the beta particles while reducing the gamma-ray intensity only slightly.[2]

Gamma-ray intensities, however, have been expressed in two ways. One gives them in r/min./gm. while the other gives them in r/mg.-hr. The differences lie only in the units of time and weight used to specify the exposure values. Since x-ray intensities are conventionally given in roentgens per minute, it seems more consistent to express gamma-ray intensities in the same way. Accordingly we shall use r/min./gm.[3]

The r/min./gm. may be obtained for any given applicator or holder by finding two things: (1) the millicurie-minutes required to produce a given effect when the particular applicator is used, and (2) the number of roentgens of x-rays required to produce the same effect. Then the (equivalent)

$$\text{r/min./gm.} = \frac{r}{\text{mc.-min.}} \times 1000$$

The transition from ordinary gamma-ray units (mc.-min.) to equivalent roentgens is made by means of a conversion factor which consists of the ratio of gamma-ray dose (in mc.-min.) to x-ray dose (in roentgens) required to produce the same effect on a given test object. The constant 1,000 merely reduces millicuries to curies and gives the measurements in terms of a gram of radium rather than a milligram.

Two attempts have been made to measure gamma rays directly (Failla, 1931 and Mayneord, 1934). Values obtained by these investigators working independently are in agreement when derived under the same conditions, but vary from around 36 to 86 r/min./gm., depending upon the position, location, and type of measuring instrument employed. They both found that it is practically impossible to take full account of the secondary electrons when gamma rays are used, as is required by the definition of the roentgen, thus making it doubtful whether gamma-ray quantities can be determined satisfactorily in roentgens by the direct method.

The indirect method of measurement appears to avoid some of the difficulties, at

[2] Filters of 0.9 mm. of lead or 2 mm. of brass may be considered equivalent to 0.5 mm. of platinum in this respect.

[3] The r/mg.-hr. may be obtained at any time, however, by dividing the r/min./gm. by $16^2/_3$.

TABLE I.—THE MEASUREMENT OF GAMMA RAYS IN ROENTGENS

1 cm. Distance from a Point Source; Filtration the Equivalent of 0.5 mm. Pt

| Name | Year | Reference | Test Object | Effect Meas. | r/mg.-hr. | r/min./gm. |
|---|---|---|---|---|---|---|
| **Direct Method** | | | | | | |
| Failla and Henshaw | 1931 | 3 | ion. chamber | ionization | 2.16* | 36* |
| Mayneord and Roberts | 1934 | 19 | ion. chamber | ionization | 3.06* | 51* |
| **Indirect Method (Ionization)** | | | | | | |
| Glasser and Mautz | 1930 | 8 | ion. chamber | ionization | 7.4 | 123 |
| Friedrich *et al.* | 1934 | 6 | ion. chamber | ionization | 7.9–11.2 | 132–187 |
| Jaeger | 1934 | 16 | ion. chamber | ionization | 7.35 | 122 |
| Mayneord and Roberts | 1934 | 19 | ion. chamber | ionization | 8.9 | 148 |
| Sievert | 1934 | 27 | ion. chamber | ionization | 7.55 | 126 |
| Friedrich | 1935 | 7 | ion. chamber | ionization | 7.8 | 130 |
| Murdock and Stahel | 1935 | 20 | ion. chamber | ionization | 8.1 | 135 |
| **Indirect Method (in Liquid)** | | | | | | |
| Taylor and Mohler | 1935 | 28 | $CS_2$ | ionization | 6.9 | 115 |
| **Indirect Method (Biological)** | | | | | | |
| Braun | 1930 | 1 | *Ascaris* eggs | killing | 5.3 | 88 |
| Holthusen and Hamann | 1932 | 14 | skin | erythema | 5.3 | 88 |
| Neeff | 1934 | 21 | skin | erythema | 5.7–6.3 | 95–105 |
| Exner and Packard | 1935 | 2 | *Drosophila* eggs | killing | 5 | 83 |
| Henshaw and Francis | 1936 | | *Drosophila* eggs | killing | 5.4 | 90 |

* See text for further information on these values.

least in practice, and accordingly has been used more extensively (Table I). A number of measurements have been made with small thimble-type ionization chambers. The procedure has been as follows: The small chamber is calibrated in a beam of x-rays, the intensity of which has been measured with a standard chamber in accordance with the requirements of the roentgen. It then is placed in the gamma-ray beam and the measurement made. Presumably, therefore, since the chamber has been calibrated to give readings in roentgens, the gamma-ray readings should be in roentgens also. The results obtained by various investigators are shown in Table I and will be seen to vary as much as 35 per cent. Furthermore, the values obtained by the indirect method (122 to 187 r/min./gm.) will be seen to be in a range quite apart from those obtained by the direct method (36 to 51 r/min./gm.). The average difference is in the order of 300 per cent. From the work of Failla and collaborators (1933), it appears that the kind and thickness of material used in the construction of the small chambers have much to do with the amount of ionization detected when different wave lengths of radiation are used.

Because of the difficulties experienced in the physical measurements of gamma rays, both directly and indirectly, the biological measurements assume greater prominence.[4] Like the thimble-type chambers, living test objects may be used without regard to secondary radiation and thus give a measure of gamma rays in equivalent roentgens for conditions met with in practice. The biological work, however, is of twofold importance. Not only does it give a measure of gamma rays in equivalent roentgens, but also information on the question of the relative biological effectiveness of different wave lengths of radiation. If it is found, for example, that the gamma-ray value in roentgens is the same in every case, irrespective of the type of biological test object used, it will follow that the various wave lengths of radiation produce the same relative effect and that they manifest no selective action. On the other hand, if it is found that the gamma-ray value in roentgens is different when different test objects are used, it will follow that differential effects are produced by the different wave lengths of radiation and that some degree of selectivity is expressed.

Only a few intensity measurements of gamma rays have been made with living material, however, under conditions which can be compared. Gamma-ray sources are usually of a shape and distribution (tubes, cylinders, and plaques) which make the factors of distance and filtration difficult to estimate accurately, especially when the source has a dimension of more than 1 cm., and the distance from the source to the material is 1 cm., or less.

Biological measurements of gamma rays have been made by Braun (1930) using *Ascaris* eggs, and by Holthusen and Hamann (1932), and Neeff (1934) using human skin (erythema). While these investigators used distributed sources instead of a point source, Sievert (1934) has, for purposes of comparison, adjusted the values by rough calculation to the standard conditions mentioned above. Sievert's corrected values are shown in Table I where it will be seen that they range quite close together. This consistency, however, cannot have a very significant meaning in view of the rather uncertain corrections that were necessary.

Packard (1928) carried out a series of experiments under conditions that were reproducible and to some extent more clearly defined. He exposed the eggs of *Drosophila melanogaster* on the surface of a hard rubber cylinder. The cylinder was approximately 2 cm. in diameter and contained glass radon tubes at the center surrounded with a small cylinder of lead, the wall thickness of which was 2 mm. Thus, with the radon tubes packed close together at

[4] Some of the first attempts to measure x-rays and gamma rays in the same unit were carried out with biological material (Frederich and Opitz, 1920; Lahm, 1925; Jona, 1926; Schneider, 1926; Zuppinger, 1928). Certain of this early work has been reviewed by Glasser in 1930.

the center and the material arranged at the surface of the hard rubber cylinder, the position of the test material with respect to the source of radiation was quite uniform. With this arrangement Packard found 5,300 mc.-min. of gamma rays were required to produce the same effect (50 per cent killing) as 180 roentgens of x-rays. But, as will be brought out more clearly below (Fig. 6), the factors of distance and filtration cannot be computed accurately.

Realizing the necessity of irradiating living test material under conditions still more like the adopted standard conditions if reliable comparisons were to be made, Failla, of this laboratory, developed a holder or applicator which met the standard conditions in practically every detail (described below). Packard and Exner became interested in such a holder in order that they might carry out Packard's experiments under more suitable conditions. Accordingly, a holder was made through the co-operative efforts of the Institute of Cancer Research and the Memorial Hospital, and experiments with *Drosophila* eggs have been carried out in both institutions. The results obtained by Packard with the new holder (spherical) have already been published (Exner and Packard, 1935). These investigators obtained a final value of 83.3 equivalent r/min./gm. (5 r/mg.-hr.) for the standard conditions.

The experiments presented by Exner and Packard and those presented here were jointly planned for the purpose of testing the reproducibility of the equivalent r/min./gm. value for gamma rays as determined with *Drosophila* eggs. Inasmuch as the same holder was used in both cases, the essential differences consisted of different laboratory environments (mainly temperature), different laboratory strains of *Drosophila*, and different radon bulbs. Under these circumstances, an agreement between the values of our respective experiments will tend to establish a reliable ratio (or conversion factor) between gamma-ray doses and x-ray doses for one kind of test object.

In addition to the work with the spherical holder, we have carried out experiments with the cylindrical holder used by Packard,[5] in 1928. Our experiments with the two holders were carried out in the same way and at the same time, thus making it possible to compare them directly.

Furthermore, we have used eggs of different ages. Eggs three hours older than those used for the experiments just mentioned are several times more resistant to radiation, a fact pointed out by us in 1933 and confirmed by Packard in 1935. The r/min./gm. has been obtained with this material using the spherical holder. The results obtained will also be presented.

## MATERIALS AND METHODS

The eggs of a wild-type strain of *Drosophila melanogaster* (Oregon strain) were used for all of the experiments to be reported here. The adult flies were cultured in bottles in the usual way on a molasses-cornmeal medium. Eggs were collected from actively laying flies which were usually four days old. Collection was accomplished by placing slides, on which the flies were to deposit the eggs, in clean dry bottles containing several hundred flies. The slides as used were covered with black filter paper moistened with yeast and banana juice. At the end of one hour, they were removed and examined to see whether the flies were laying actively. If there were not a large number of eggs present, the flies were put aside and not used. If there were, fresh slides were placed in the bottles and left for two hours. The eggs laid during this time were removed with a soft brush to small pieces of paper suitable for handling during treatment.

The one hour pre-laying period was a precaution to insure greater uniformity in age of eggs. If the flies were found to be laying actively, it was assumed (1) that most of the fertilized eggs which the female flies sometimes have a tendency to carry in the vagina for a period before laying, were fairly well eliminated, and (2) that the

[5] We wish to express our indebtedness to Dr Packard for the privilege of using this holder.

eggs were being deposited at a fairly uniform rate. Packard used a somewhat different procedure for eliminating the older eggs. He collected the eggs in the usual way without bothering about a pre-laying period, carried out his experiments during the early afternoon of one day, and left the material in moist chambers overnight at room temperature. The next morning, when the eggs were around 20 hours old, he counted them, rejecting all those that had hatched. He assumed that the first to hatch were older, more resistant to the radiation and, therefore, should not be considered along with the others. Such procedure has not been satisfactory in our laboratory, however. Packard points out that there are one or two and rarely more than five or six in a sample of 100 that hatch within 20 hours. We, on the other hand, find that as many as 50 per cent may hatch during this period, depending upon the temperature of the room. Since our laboratory is located in a hospital, our average temperature (22° to 26° C.) was higher than Packard's laboratory which is not in a hospital. Thus, an explanation is offered for the differences observed. In any case, it is clear that we could not follow the same procedure in eliminating older eggs.

For our experiments, treatment began regularly 30 minutes after the end of the collection period when the younger material was used, and three and one-half hours after the end of the collection when the older material was used. Practically every time an experiment was carried out with one of the gamma-ray applicators a similar experiment was done with x-rays, using a portion of the same collection of eggs and treated at the same time. This was an attempt to prevent any differences in age, stage, rate of growth, etc., in different collections from affecting the gamma-ray results without affecting the x-ray results in the same way. By this procedure, the x-ray results served as a base reference for the gamma-ray results obtained with the different applicators. If it was found that the x-ray results were generally alike in the two cases, it is obvious that the two types of gamma-ray results could be compared directly.

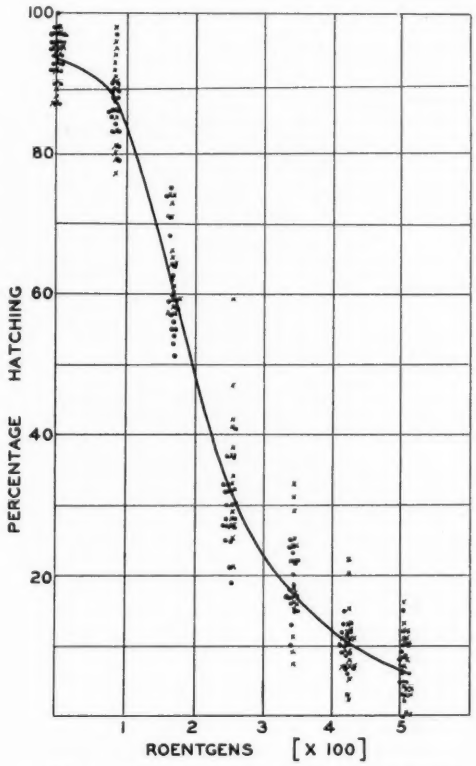


Fig. 1. X-ray curve showing how percentage of eggs hatching varies with the dose of radiation administered.

## EXPERIMENTS WITH X-RAYS (EGGS ONE-HALF HOUR OLD)

The material treated with x-rays, as mentioned, was composed of portions of the samples collected for gamma-ray treatment. The eggs were collected as described and removed with a soft brush to small rectangular strips of thin soft paper (drug store "kleenex") 2 mm. in width and 8 mm. long and moistened with tap water. The eggs were spread evenly one layer thick in such a way that each paper contained well over 100 eggs. These were placed in a tray made by gluing sheet celluloid 0.015 mm. thick to an embroidery

hoop. The tray then was placed at a point 50 cm. distance from the center of the target of the x-ray tube so that nothing was beneath the test material (within 20 inches) except the 0.015 mm. of celluloid. Thus back-scattered radiation was reduced to a minimum.

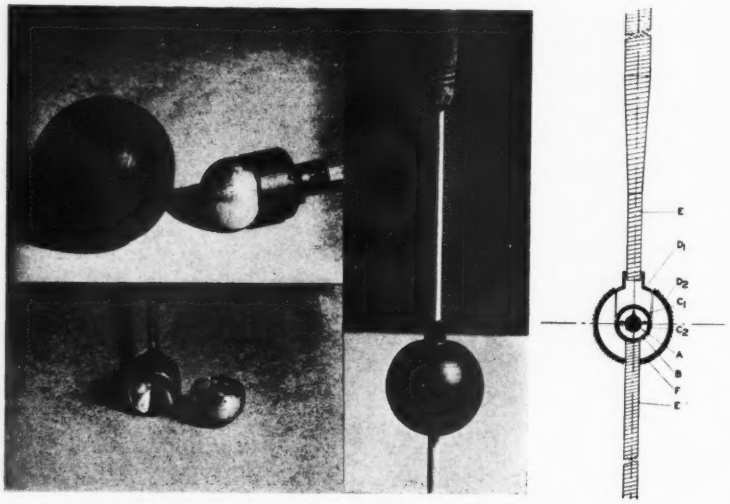


Fig. 2. Photographs and figure showing details of the spherical applicator. (A) radon bulb; (B) paraffin; ($C_1$) and ($C_2$) sections of hollow platinum sphere; ($D_1$) and ($D_2$) sections of bakelite sphere; (E) swab stick support; (F) test material.

The irradiation conditions were as follows:

| | |
|---|---|
| 200 | kv. |
| 169 | pv. |
| 30 | ma. |
| 50 | cm. dist. to material |
| 34 | cm. dist. to filter |
| .8 mm. Cu, 1.15 mm. Cellu | filter |

The intensity was kept uniform by means of an ionization chamber-galvanometer arrangement. An ionization chamber was placed in a fixed relation to the x-ray tube (not in the beam used for treatment) and connected to a galvanometer near the control panel. Thus, by keeping the galvanometer reading constant, it was certain that the intensity of radiation emitted by the tube remained constant. Having selected an intensity of radiation to work with, this was carefully measured in roentgens per minute at the point at which the test material was placed. This was done with a small thimble-type ionization chamber with an inside diameter of 1.52 cm. and a wall thickness of 1.4 mm. Previous to use, the chamber was calibrated against a standard open-type ionization chamber.

By keeping the galvanometer reading constant, calibrations were made from time to time during the course of the work which covered a period of several months in order to detect any drift in the galvanometer or other parts. The values obtained were as follows:

| | |
|---|---|
| 4/5/35 | 43.3 r/min. |
| 4/30/35 | 42.3 |
| 6/20/35 | 41.5 |
| 9/17/35 | 41.2 |
| 10/1/35 | 41.5 |
| 11/1/35 | 43.5 |
| 11/29/35 | 42.8 |
| | Av. 42.3 ± 0.3 A.D. |

Despite all the precautions which were taken, a small amount of variation occurred in the measurements as indicated, but since this was small the average value will be taken as the intensity used.

Treatment was carried out by exposing the organisms to the direct beam of the rays for different periods of time. Samples were removed at two-minute intervals. The irradiated samples, together with con-

trols, were put away in moist chambers to await hatching. After 48 hours, the eggs were counted and the percentage hatched was determined.

The results obtained are shown graphically in Figure 1, without corrections or modifications. The points marked (x) were obtained in tests carried out in connection with the cylindrical applicator, while those marked (.) were carried out in connection with those done with the spherical applicator. In all, 41 x-ray experiments were performed, around 300 samples were observed and more than 50,000 eggs were counted.

### SPHERICAL APPLICATOR EXPERIMENTS (EGGS ONE-HALF HOUR OLD)

The details of the spherical holder are shown in Figure 2. As will be seen, the main portion of this is composed of a bakelite sphere ($D_1$) 18.6 mm. in diameter with a hole drilled into it to a proper depth and rounded at the bottom. Into this hole is fitted a bakelite plug ($D_2$) which supports a spherical platinum filter ($C_1$ and $C_2$) and a radon bulb (A). The device is constructed in such a way that the bulb and platinum sphere are held precisely at the center when the plug is pushed all the way in. The platinum filter consists of two sections, $C_1$ and $C_2$, machined out of solid bar in such a way that $C_1$ fits into $C_2$ making a closed hollow sphere with a wall thickness of 5 mm. and an outside diameter of 9.2 mm. Inasmuch as the inside diameter was 8.2 mm., and since the outside diameter of the radon bulb (A) was 3.5 mm., some provision had to be made to hold the bulb at the center. This was done by moulding and drilling out a piece of paraffin (B) to proper dimensions.

Thus, since the radiation source was spherical in shape and placed at the center of a spherical holder, it provided very nearly an effective point source, and since the filter was uniform in thickness and was arranged with spherical symmetry around an effective point source of radiation at the center, a uniform radiation was provided at every point on the surface of the holder.

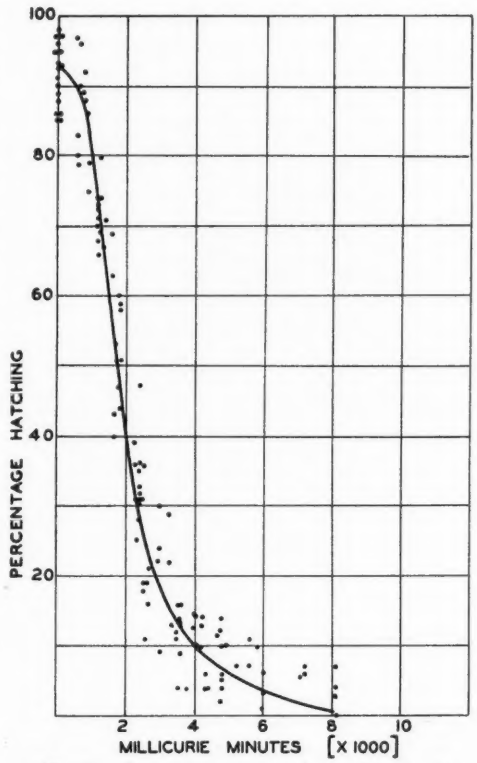


Fig. 3. Gamma-ray curve obtained with the spherical applicator, showing how percentage of eggs hatching varies with the dose of radiation administered.

The platinum acted to stop all of the beta rays and the bakelite acted to stop the secondary radiation generated by the platinum. As mentioned, the outside diameter of the bakelite sphere was 18.6 mm., making the distance from the center 9.3 mm.[6] Adding 0.1 mm. for the thickness of paper used to support the eggs and half the thickness of the eggs, the distance from the effective point source to the central region of the test material was 9.4 mm.

The bakelite sections $D_1$ and $D_2$ were supported on the ends of "swab sticks"

[6] It will be noticed that the dimension of the outside diameter given here and the one given by Exner and Packard differs by 0.1 mm. This is because the larger bakelite section used by Exner and Packard was not available when these experiments were carried out. A second section was, therefore, made from the same stock material, the diameter differing by the amount indicated. The other parts of the holder were the same as those used by Exner and Packard.

(E, Fig. 2). One of these was sunk into a dowel rod so that the whole could be handled at a distance. With this arrangement the sphere containing eggs and the plug containing radon were easily and safely handled. During treatment the applicator was suspended from the ceiling by a string attached to the dowel rod. It was arranged in a large room so that the nearest table or article was at least four feet away, thus rendering the back-scattered radiation coming from secondary radiators outside the holder quite insignificant.

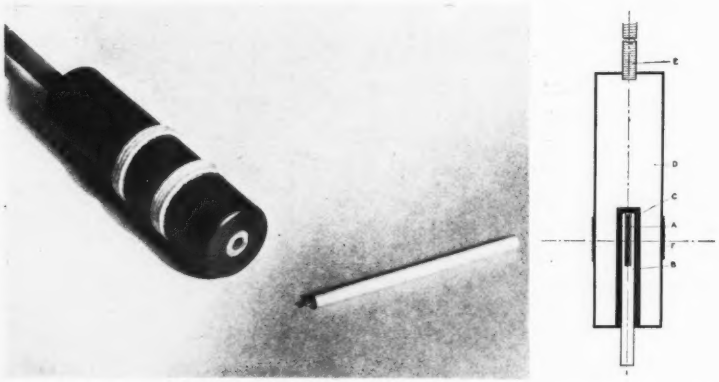

Fig. 4. Photograph and figure showing details of the cylindrical applicator. (A) radon tube; (B) paper tube; (C) lead filter; (D) hard rubber cylinder; (E) dowel rod support; (F) test material.

For the experiments carried out with the spherical applicator, the eggs were collected and handled as described in case of the x-ray experiments, except that they were placed on pieces of "kleenex" which were lens-shaped. When these pieces of paper were well wetted and placed on the surface of the sphere, they clung to the surface and conformed to its curvature, thus making the distance uniform.

The initial strength of the radon bulb as used was usually around 500 mc. Intensity measurements were made according to the usual procedure employed at the hospital, except that an additional measurement was made in a few cases when the bulb was around 50 mc., since the strength of our radium standard was around 50 mg. When deterioration had been taken into account, the differences between the earlier and later measurements were insignificant.

Treatments were carried out as follows: The egg samples were placed on the surface of the sphere and the exposure started by inserting the plug which supported the platinum sphere and radon bulb. The exposure was stopped by removing the plug. At regular intervals, usually two minutes, two or three samples were removed until the series was finished. The interval of treatment was determined by the intensity of the source, and since the dose administered depended entirely on this, it was determined with all possible precision. At the end of treatment the irradiated samples, together with controls, were put away in moist chambers for 48 hours to await hatching. At the end of this time the percentage hatching was determined and recorded. Twenty-two complete experiments were carried out, about 175 samples were observed, and more than 25,000 eggs were counted in connection with the spherical applicator work. The results are shown graphically in Figure 3 without corrections or adjustments.

### CYLINDRICAL APPLICATOR EXPERIMENTS (EGGS ONE-HALF HOUR OLD)

The applicator used by Packard in 1928

is shown in Figure 4. It was made up of a solid hard rubber rod (D) into which was sunk a lead cylinder at the center. The inside diameter of the lead cylinder was 2.2 mm. and the wall thickness was 2 mm. The thickness of the hard rubber surrounding the lead cylinder was 8.05 mm., making the distance from the center to the surface 11.15 mm. The hard rubber cylinder was firmly attached to a dowel rod (E) about 18 inches long, which was sunk a short distance into the end opposite to the lead. With this the cylinder was conveniently and safely handled even though it contained radon. During treatment the cylinder was suspended from the ceiling as in the case of the sphere.

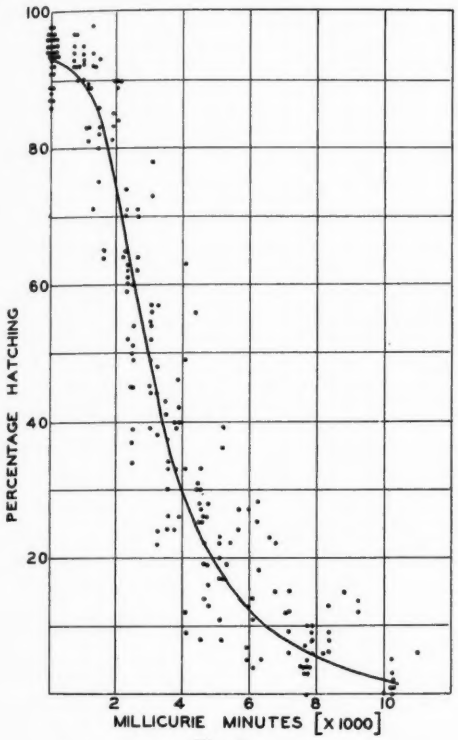


Fig. 5.

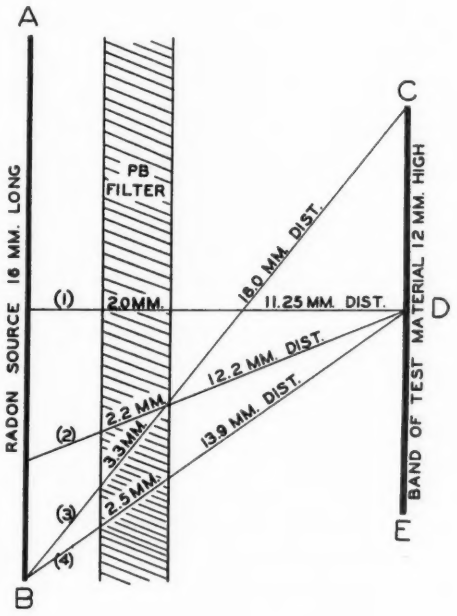


Fig. 6.

Fig. 5. Gamma-ray curve obtained with the cylindrical applicator, showing how percentage of eggs hatching varies with the dose of radiation administered.

Fig. 6. Diagram showing details in regard to distance and filtration when the cylindrical applicator is used.

For the experiments performed, we used a radon source (A) at the center of the cylinder having an initial strength around 500 mc. Different numbers of tubes (bare) were used, depending on the strength of those available. Usually one or two were used, but the number reached as high as seven. Since the opening in the center of the holder was larger than the combined diameter of the radon tubes, the tubes (or tube) were carefully centered by placing them together in a snug bundle inside a paper tube (B), the wall thickness of which was adjusted in each case to accommodate the number of tubes used. The radon tubes were made secure at one end of the paper tube (B), the wall thickness of which was adjusted in each case to accommodate the number of tubes used. The radon tubes were made secure at one end of the paper tube which was made long enough to protrude beyond the end of the holder. Thus, by handling the paper tube

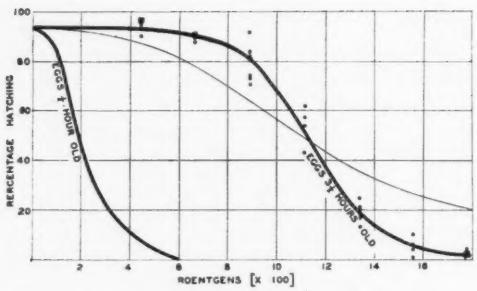


Fig. 7.

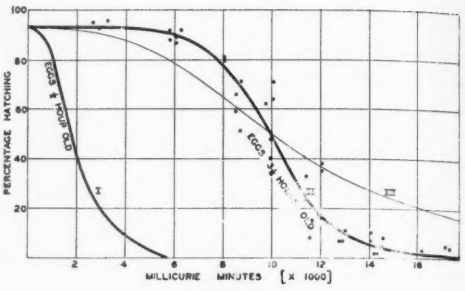


Fig. 8.

Fig. 7. Curve comparing the radiosensitivity of eggs of different ages to x-rays. Curve (1) is for eggs one-half hour old after the end of collection, and Curve (2) is for eggs three and one-half hours old after the same time. Curve (3) is drawn similar to Curve (1) with the 50 per cent point coinciding with the 50 per cent point of Curve 2.

Fig. 8. Curve comparing the radiosensitivity of eggs of different ages to gamma rays. Curve (1) is for eggs one-half hour old after the end of collection, and Curve (2) is for eggs three and one-half hours old after the same time. Curve (3) is drawn similar to Curve (1) with the 50 per cent point coinciding with the 50 per cent point of Curve (2).

it was possible to insert and remove the radiation source from the holder with ease.

The eggs were collected as described above and arranged on small rectangular strips of moist "kleenex." The samples thus prepared were then placed on the surface of the cylinder directly over the place where the radon tubes would be when the paper tube was pushed in as far as it would go. As many as 20 samples with as many as a hundred eggs or more could be placed on the available area. The thickness of the paper and half the thickness of the eggs was about 0.1 mm., making the distance from the center of the cylinder to the center of the eggs 11.25 mm.

Treatment was carried out by inserting the radon tubes for definite periods of time, the timing taking place as in case of the spherical holder. At the end of treatment the irradiated samples, together with controls, were put away in moist chambers to await hatching. After 48 hours the samples were examined and the percentage hatching was determined in each case. The results with no corrections or adjustments are shown graphically in Figure 2. This represents 45 complete experiments, about 350 samples observed and approximately 50,000 eggs counted.

Some of the difficulties arising when calculating dosages administered with this type of applicator can be realized by a study of Figure 6. The distance and thickness of filter, etc., are accurately known for the radiation which travels along line (1), but only part of the radiation follows such a course. Some of it travels along lines (2), (3), and (4), etc., making the integrated dose delivered to the sample of test material as a whole practically impossible to compute.

## EXPERIMENTS WITH EGGS THREE AND ONE-HALF HOURS OLD

For the experiments thus far described, only eggs one-half hour old after the end of the collection period were used. As pointed out in the introduction, these same organisms when three hours older are several times more resistant to radiation. Although only slightly different in age, they are vastly different in stage of development and response to radiation. Hence it is of interest to determine whether such organisms give the same equivalent r/min./gm. for gamma rays as the younger material.

This was investigated with the sphere applicator and precisely the same procedure was used as before except that an interval of three and one-half hours was allowed to intervene between the end of the collection period and the time when treatment began.

The results are shown in Figures 7 and 8. Figure 7 is for x-rays. Curve 1 of this figure is for eggs one-half hour old and is copied from Figure 1. The experimental points are for eggs three and one-half hours old, and Curve 2 is the best curve that could be drawn through them. Figure 8 is for corresponding gamma-ray experiments.

Referring to Figure 7, the difference in position of Curves 1 and 2 represents the difference in susceptibility of the eggs of the different ages. For example, 197 roentgens were sufficient to kill 50 per cent of the younger eggs, whereas, 1,130 roentgens were required to kill the same percentage of older eggs. Referring to Figure 8, it will be seen, likewise, that 1,800 and 10,000 mc.-min., respectively, were required to kill half of the eggs for the two ages. The relative values for different degrees of effect are given in Table II.

Since the corresponding ratios in the two cases are so nearly the same, it is clear that the organisms respond in essentially the same way to the different radiations at the two stages, and that the older material is roughly six times more resistant than the younger.

Curve 3, shown in both Figures 7 and 8, has been drawn similar to Curve 1 in each case, with the 50 per cent point coinciding with that of Curve 2. It will be seen at once that Curve 3 does not fit the experimental points except in the neighborhood of 50 per cent. The higher values in each case lie above Curve 3, whereas, the lower values lie below it.

Packard (1935), dealing with the radiosensitivity of eggs of different ages, found as we did (Henshaw and Henshaw, 1933) that the radiosensitivity of the eggs varies markedly with changes in age. He found, however, that the shape of the curves for the different ages of material was similar, and questioned the validity of our findings. We wish to point out and emphasize that for this work Packard digressed from his standard procedure and used eggs collected during one-half hour rather than during two hours as usual for his work and as we have done. Thus, in view of the fact that the radiosensitivity varies so markedly with age and that the length of the collection period in the two cases was very different, the two sets of results cannot be compared.

## DISCUSSION OF RESULTS

From Figures 1, 3, and 5, which show results for eggs one-half hour old after the end of collection, it will be seen that the fertility of the controls (*i.e.*, the percentage hatching) ranges generally above 90 per cent. In a few cases the fertility dropped below 85 per cent but the results obtained with such material were discarded. The value of 93 per cent was taken, therefore,

TABLE II.—DOSES REQUIRED TO PRODUCE THE SAME EFFECT

| Percentage Effect | X-rays (r) | | | Gamma rays (mc.-min.) | | |
|---|---|---|---|---|---|---|
| | Eggs one-half hr. old (A) | Eggs three and one-half hr. old (B) | Ratio $\frac{(B)}{(A)}$ | Eggs one-half hr. old (C) | Eggs three and one-half hr. old (D) | Ratio $\frac{(D)}{(C)}$ |
| 75 | 125 | 960 | 7.7 | 1,150 | 8,200 | 7.1 |
| 70 | 140 | 995 | 7.1 | 1,300 | 8,650 | 6.7 |
| 65 | 155 | 1,035 | 6.7 | 1,450 | 9,000 | 6.2 |
| 60 | 170 | 1,065 | 6.3 | 1,600 | 9,350 | 5.9 |
| 55 | 184 | 1,100 | 6.0 | 1,760 | 9,700 | 5.5 |
| 50 | 197 | 1,130 | 5.7 | 1,900 | 10,000 | 5.3 |
| 45 | 210 | 1,160 | 5.5 | 2,070 | 10,300 | 5.0 |
| 40 | 224 | 1,190 | 5.3 | 2,200 | 10,500 | 4.8 |
| 35 | 241 | 1,220 | 5.0 | 2,400 | 10,800 | 4.5 |
| 30 | 264 | 1,250 | 4.7 | 2,560 | 11,000 | 4.3 |
| 25 | 291 | 1,285 | 4.4 | 2,800 | 11,400 | 4.1 |
| | | Average | 6.14 | | Average | 5.86 |

TABLE III.—DOSES OF RADIATION REQUIRED TO PRODUCE THE SAME EFFECT

| Percentage Effect | Roentgens of x-rays (A) | mc.-min. (sphere) (B) | mc.-min. (cylinder) (C) | Ratio (A)/(B) | Ratio (A)/(C) |
|---|---|---|---|---|---|
| 75 | 125 | 1,150 | 2,000 | .109 | .062 |
| 70 | 140 | 1,300 | 2,200 | .108 | .064 |
| 65 | 155 | 1,450 | 2,350 | .107 | .066 |
| 60 | 170 | 1,600 | 2,550 | .106 | .065 |
| 55 | 184 | 1,760 | 2,800 | .104 | .067 |
| 50 | 197 | 1,900 | 3,000 | .104 | .066 |
| 45 | 210 | 2,070 | 3,250 | .102 | .065 |
| 40 | 224 | 2,200 | 3,550 | .102 | .063 |
| 35 | 241 | 2,400 | 3,900 | .100 | .062 |
| 30 | 264 | 2,560 | 4,300 | .103 | .061 |
| 25 | 291 | 2,800 | 4,750 | .104 | .061 |
| | | | Average | .1045 | .0635 |

as the fertility of the controls for each group and is the point through which the curves are drawn in the figures.

Analysis of the three sets of data was carried out as follows: First, the best curves were fitted to the experimental points as shown in the figures. Ratios of x-ray dose to gamma-ray dose (spherical holder) and x-ray dose to gamma-ray dose (cylindrical holder) were then obtained for corresponding levels of effect along the curves. These are shown in Table III.

It will be seen that the central more dependable range of the curves bear practically a constant relation to each other. This indicates that the curves are similar in shape and creates the presumption that the same kind of effect is produced, irrespective of the type of radiation or the type of holder used.

Considering the spherical holder results only for the moment and following the procedure outlined in the introduction, the equivalent roentgen value for gamma rays may be obtained from the average value at the bottom of next to the last column in Table III, 0.1045. This is the conversion ratio mentioned previously and needs only to be multiplied by 1,000 to give the r/min./gm. It, accordingly, becomes 104.5. This, however, is for a distance of 9.4 mm. (see description of the spherical applicator and of the conditions used). Correcting this for 1 cm. distance by means of the inverse square law the value becomes 92.3. Deducting, as did Exner and Packard, 1 per cent for the absorption in bakelite,[7] we have as a final value 91.4 r/min./gm. to be compared with the value of 83.3 obtained by Exner and Packard.

Exner and Packard used a somewhat different procedure in analyzing their results. They obtained a conversion factor for each gamma-ray exposure made, by referring each gamma-ray effect value (percentage hatching) to the x-ray curve and finding the x-ray dose required to produce the same effect. Beyond this their procedure was the same as ours. The essential difference in the two cases was that they computed the equivalent r/min./gm. (in their case, r/mg.-hr.) for each gamma-ray value obtained experimentally, whereas we computed it only once from curves fitted to the experimental points.

When our results are analyzed in accordance with the method used by Exner and Packard, a final value of 89.7 r/min./gm. is derived, which differs from our other value, 91.4, by less than 2 per cent. Since there is little choice between the values obtained by the two methods, we shall adopt the intermediate even figure of 90 as the equivalent r/min./gm. of gamma rays obtained at 1 cm. distance from a point source with *Drosophila* eggs. This differs from Exner and Packard's value by 8 per cent, a reasonably close agreement considering the possible sources of error in such an experiment. We have chosen to present in detail the graphic method of analyzing the results because it displays the results to better advantage.

The findings obtained with the cylindrical holder will now be considered. As indicated above, the arrangement of this holder (Fig. 6) makes it practically impossible to reduce the values obtained to the standard conditions There is little point, therefore, in determining the r/min./gm.

[7] Exner and Packard have determined the composition of the bakelite used in the construction of this holder and have discussed rather thoroughly the influence of this material on the beam of gamma rays. Since we are chiefly concerned with reproducibility aside from physical corrections, we have made the same adjustment here.

TABLE IV.—DOSES REQUIRED TO PRODUCE 50 PER CENT HATCHING

| | Packard | Henshaw |
|---|---|---|
| X-rays | 190 r<br>180 r (1928) | 205 r |
| Gamma rays (cylinder) | 5,300 mc.-min.<br>(1928) | 3,100 mc.-min. |
| Ratio $\frac{\text{(mc.-min.)}}{\text{(r)}}$ | 29.7 | 14.95 |

for this holder, so that Packard's findings (1928) and ours given here may best be compared by referring to the actual values obtained.

In our presentation thus far, it has not been necessary to correct the results for fertility. Here it becomes so, however, because Packard's results are thus corrected. Accordingly, in Figure 9 the curves of Figures 1, 3, and 5 have been adjusted by making the fertility of the controls appear as 100 per cent. This was done by dividing each experimental point along the curve by 93. Such treatment changes the actual values along the curves slightly but does not alter the relationship of the curves to each other in any way. Since in Table III, the curves have been shown to be practically similar, we may take the dosage values required to produce 50 per cent hatching as representative of the relationship of the curves; such values are shown in Table IV. Similar values taken from Packard's papers are shown also.

Before comparing the values, however, certain irregularities must be considered. From Figure 9, we found the number of roentgens of x-rays required to kill half the eggs in a sample to be 205 r, whereas, Packard found it to be 190 (180 r, in 1928), a difference of about 8 per cent. This is no doubt due to the fact that the material we used was younger than that used by Packard. His was one-hour old after the end of a two-hour collection period, while ours was only one-half hour old. As indicated above, both Packard and we have shown previously that the younger material is more resistant to radiation. We chose to use the younger material so that the procedure would be in accordance with other work upon which these findings have a

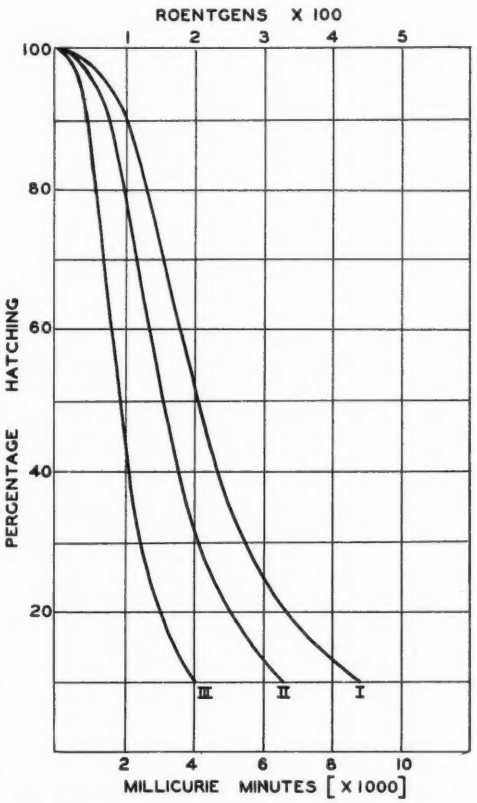


Fig. 9. Curves from Figures 1, 3, and 5 corrected so that the fertility of the controls is 100 per cent. Curve (1) is for x-ray results, Curve (2) is for cylindrical applicator results, and Curve (3) is for spherical applicator results.

bearing. The difference in susceptibility at the stages used, however, should not interfere with the determination of the r/min./gm., that is, unless there is a differential effect for these slightly different ages, which apparently is not the case in view of the findings with material three and one-half hours old. In this way the difference between Packard's x-ray value and ours may be accounted for.

Since the same kind of material was used by Packard and by us in much the same way with the cylindrical applicator, it

would be expected that generally the same results would be obtained. This was not the case, for, as shown in Table IV, Packard found 5,300 millicurie-minutes required to produce 50 per cent hatching, whereas, we found 3,100. Taking into account the difference in radiosensitivity of the materials used by determining ratios (Table IV), Packard found about twice as much radiation required with the cylinder as we did.

In conclusion, therefore, it appears that our results and Packard's obtained with the spherical applicator are in reasonable agreement, while those obtained with the cylindrical applicator are not. In view of the fact, however, that our experiments with the sphere and cylinder were carried out at the same time on portions of the same material and at a time when the influence of the age factor in *Drosophila* eggs was more fully appreciated, our results with the two holders are undoubtedly more dependable. Based on our results, the difference in effectiveness of the two holders is given by the ratio of dose which we found to produce the same effect in the two cases. Such a ratio is obtainable from the curves in Figure 9 or from the curves in Figures 3 and 5, and comes out to be approximately 1.6. This means that a given quantity of gamma rays will have about 1.6 times more effect when used in the spherical holder than when used in the cylindrical holder.

## SUMMARY

The problem of unifying the methods of measuring x-rays and gamma rays has been reviewed and discussed. The results thus far available, unfortunately, are inconclusive. The physical measurements vary among themselves and the biological measurements are uncertain because of the conditions under which they were carried out.

In the present case, an attempt has been made to use a biological test object under conditions which would permit the value obtained to be expressed with some degree of dependability for the standard conditions of 1 cm. distance from an effective point source of radiation. Through the cooperation of the Memorial Hospital and the Institute of Cancer Research, a special applicator, approaching ideal conditions, was constructed for the work and similar experiments with *Drosophila* eggs have been carried out in both institutions.

In this laboratory, an equivalent roentgen value for gamma rays of 90 r/min./gm. was obtained for the standard conditions, using eggs one-half hour old after the end of a two-hour collection period, and also using eggs three and one-half hours old which are approximately six times more resistant to the radiations. While, in these two cases, the organisms were widely different in susceptibility, they respond to the different radiations in relatively the same way, indicating no differential effect due to wave length.

The value of 90 r/min./gm. compares favorably from the standpoint of reproducibility with the value of 83.3 obtained by Exner and Packard.

*Acknowledgments.*—The writers wish to express their appreciation to Dr. G. Failla, who planned the special holder used and who offered invaluable advise throughout the course of the work; to Dr. Exner and Dr. Packard for their co-operation, and to Dr. Morton Schweitzer for assistance in analyzing the data obtained.

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# PNEUMOTHORAX IN THE NEWBORN

## REVIEW OF LITERATURE AND REPORT OF SEVEN CASES

*By* E. J. BERTIN, M.D., Misericordia Hospital, *Philadelphia*

IN April, 1933, I presented this subject before the Philadelphia Roentgen Ray Society, but it was not submitted for publication at that time. It seemed incredible that so many cases—seven—should be encountered by us in a period of four years, when a study of the literature revealed only an occasional single case report by other authors. Publication was further discouraged by the experience of at least one member of the Society, who had met with somewhat similar appearances, which he thought were due to a fold of skin, produced by pressure of the upper arm against the side of the chest, causing a shadow resembling pneumothorax. Repeated attempts, however, were made by us to produce this appearance by folding the skin in various areas on the chest and fixing the folds with adhesive plaster, but we were unable to obtain shadows which simulated those of any of our cases. Pfahler (1) had repeatedly insisted, after careful study of our films, that the appearances were unquestionably due to pneumothorax. I, therefore, wish to present seven cases of pneumothorax in the newborn, in addition to the cases reported by other authors, with a general review of the literature bearing on this subject.

Our cases were, without exception, diagnosed by the x-ray examination alone, and were discovered during the years when x-ray study of the chest in the newborn was almost a routine procedure. It is, therefore, evident that more of these cases would be found if more infants were subjected to an x-ray examination of the chest soon after birth.

A review of the literature in all languages indexed at the New York medical libraries indicates that congenital pneumothorax is an extremely rare condition, reports of only five cases having been reported up to 1930, and only a total of 22 cases up to the present writing.

Knowledge of pneumothorax in general dates back to 1803, when Itard named the condition and recognized its relation to tuberculosis.

Lænnec, in 1819, first described pneumothorax as a clinical entity, and was perhaps the first to diagnose the condition during life. He described the causes, symptoms, and physical signs, and also gave the "succussion splash" its correct interpretation. The significance of this splashing sound had not heretofore been understood; its presence was thought to indicate a moderate amount of pus in the chest, while its absence was interpreted as indicating a chest filled with pus. When pneumothorax was identified as a clinical entity, the meaning of the succussion splash became clear—a sign of the presence of fluid associated with air.

Emerson, in 1903, published an elaborate treatise on the disease, reviewed the literature, and reported 48 cases from the Johns Hopkins Hospital. Not a single case of pneumothorax in the newborn was included.

### PNEUMOTHORAX IN YOUNG CHILDREN

Pneumothorax occurs most frequently between the ages of 20 and 30 years. West (2) found that in 98 cases only six occurred before the age of 15 or after 40.

The condition is rare in persons under three years of age; West reported only one case in a patient so young. However, Moncrieff (3), Lees (4), Bashinski (5), Sanderson (6), Severre (7), and Variot (8) reported a total of eight cases in children under three years of age. Five of these were associated with pneumonia, one with scrofula, one with multiple lung abscesses

and purulent pleurisy, and one with tuberculosis.

Holt (9) stated that pneumothorax complicating tuberculosis is rare in patients under three years of age. Griffith (10) also stated that it is rare in early life, but he described it as following pneumonia, whooping cough, measles, diphtheria, emphysema, and in connection with an empyema or abscess of the lung that has burst through the pleura, or resulting from an injury due to a foreign body in the lung.

Garrod, Batten, and Thursfield (11) pointed out that the condition is usually a complication of pulmonary disease, or is caused by trauma or puncture of the lung by an exploratory needle. None of these authors refer to pneumothorax as occurring at birth or being caused by congenital conditions.

### A REVIEW OF REPORTED CASES

A careful search of the literature disclosed only 22 cases in which the symptoms of pneumothorax were probably present from birth and in which the condition may be regarded as congenital.

In 1878, Ruge (12) reported the occurrence of pneumothorax in a newborn male child. Birth was by breech presentation, and the infant was delivered feet first, but delivery of the arms and head was not difficult. He was moderately asphyxiated when born, but cried considerably during the night. The following morning, he suddenly became cyanotic, and died shortly afterward.

At autopsy, when the left half of the thorax was opened, air rushed out. The heart was displaced to the right. The left lung was pressed against the spinal column. When placed in water, it sank but showed some small areas containing air. There was a small emphysematous area, and the pleura showed an irregular tear about 3 cm. long. There was some free blood in the pleural cavity. The right lung was normal.

Ruge was of the opinion that, owing to premature respiration and inhalation of slime, meconium, and vernix caseosa before expulsion of the child, the respiratory passages were blocked, at least on the left side, and that, following more active respiration and crying, a circumscribed alveolar, later interstitial emphysema developed resulting in a rupture of the pleura. He did not attribute the cause of the condition to the method of delivery.

In 1917, Scheltema (13) reported the occurrence of pneumothorax in a child of seven weeks, with symptoms noted from birth. The child was born asphyxiated after normal labor. The mother said that in breathing the child moved its sides, suggesting exaggerated inspiratory retraction in the lowermost portion of the thorax. This sign was found to be bilateral and appeared only in the lowermost portion of the thorax, more on the left than on the right side. Respiration was somewhat accelerated, but the child presented a normal, well-nourished appearance. On crying, slight cyanosis appeared.

On percussion, a somewhat muffled sound with a tympanitic note was heard in front and behind on the left side. On the right side, anteriorly, distinct dullness began below the clavicle, bounded externally by the nipple on the right side and by the sternum on the left. The apex beat could not be felt at the usual site. As a weak apex beat could be felt on the right side and cardiac dullness was not present on the left side, the heart was presumably displaced to the right. On the right side, the usual puerile breathing was heard; on the left side, the breath sounds were distant.

The symptoms pointed to the absence of the lung in the left half of the thorax and to a considerable displacement of the heart, with the mediastinum, to the right. This assumption was confirmed by the roentgen observations and transillumination at that time and three months later.

The most plausible explanation for the condition would seem to be aplasia of the lung, with an open communication between the pleuraless thoracic cavity and the bronchus. Diaphragmatic hernia could be excluded. The reason for the absence of fluid was not clear, but the condition could be clinically defined as pneumothorax.

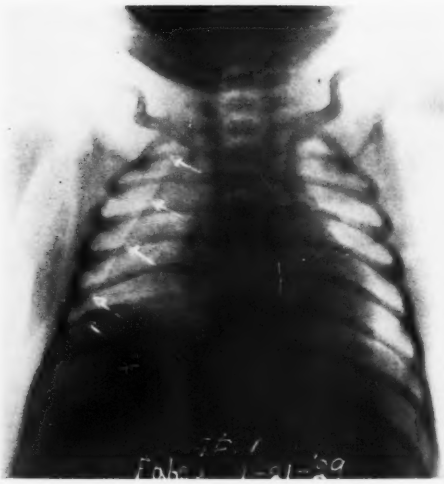

Fig. 1.

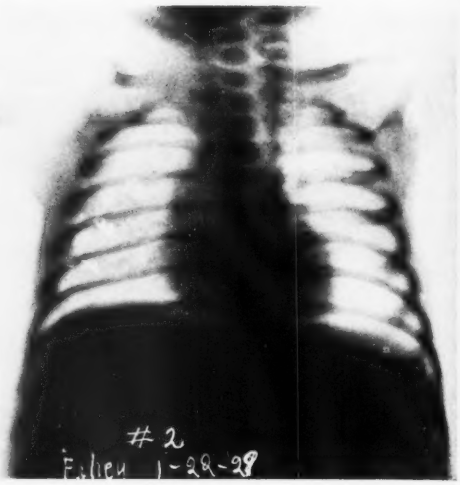


Fig. 2.

Fig. 1. Case 1. Showing pneumothorax of outer third of the right chest, ten days after birth.
Fig. 2. Case 1. Film made one day later than Figure 1. Still shows air in right pleural cavity.

Smith (14), in 1919, reported the occurrence of pneumothorax in an infant first examined at seven weeks of age. The labor was normal, and the child breathed after brief resuscitation. The mother noted that the child had always breathed rapidly and with difficulty. It was brought to the hospital because of eczema on the face and buttocks. The lungs showed hyper-resonance on the left side, with absence of breath sounds. The heart was displaced to the right and the breath sounds in the upper part of the right lung were poor. Roentgen examination showed cloudiness in this portion of the lung. Râles were present in both lungs.

When the child was three months of age, the condition became worse. The infant had several convulsions, and aspiration of the chest drew air. The right lung became filled with râles; bronchopneumonia developed and the child died. Pneumonia was not present before the onset of the trouble. The diagnosis was complete pneumothorax on the left side, with subcutaneous emphysema on the left side of the chest.

Flipse (15), in 1928, reported the occurrence of pneumothorax in a newborn infant, delivered by forceps. When the child attempted to breathe, little air entered the lungs. It was necessary to introduce a small tracheal catheter. Respiration was established in a few moments but was of an unusual type; expansion of the chest was limited almost entirely to the left side. The catheter was withdrawn and the child cried in a feeble but normal manner. Cyanosis, however, developed on slight exertion.

Roentgen study showed the heart to be displaced almost completely to the right of the sternum. The left lung appeared about 50 per cent collapsed, with a well-defined area of pneumothorax surrounding it. By the use of oxygen during cyanosis, the child was carried along. X-ray films were made at 24-hour intervals, and showed progressive collapse of the left lung, until it was totally collapsed when the infant was two days old.

Thirty cubic centimeters of air was removed from the left side of the thorax by puncture in the midaxillary region. Immediate roentgen examination showed the heart nearly normal in position, with some expansion of the left lung.

On the following day, the lung was again

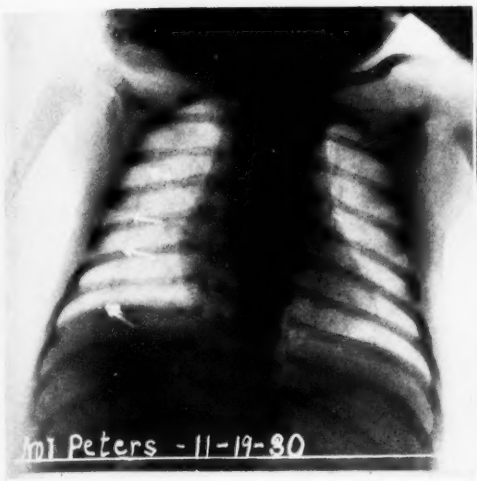


Fig. 3.

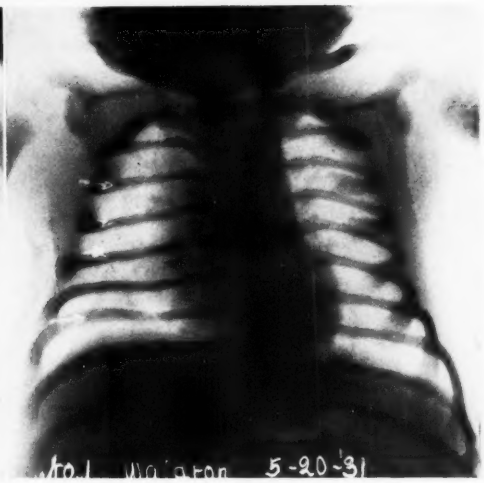


Fig. 4.

Fig. 3. Case 2. Showing partial collapse of right lung with pneumothorax in the outer third of the right chest (eight days old).

Fig. 4. Case 3. Showing a small area of pneumothorax in the lateral aspect of the right pleural cavity (twelve days old).

collapsed, and 18 c.c. of air was again withdrawn. Shortly afterward, the child developed stridor, retraction of the thorax, and cyanosis. Oxygen was administered. X-ray films taken on the following day showed the left lung in apposition with the wall of the chest except along the lower border. The heart was in practically normal position, and the general condition of the child was satisfactory.

Flipse suggested that the cause of the stridor was collapse of the epiglottis, which the infant probably had at birth, and which obstructed the larynx. Inspiratory efforts may have ruptured an alveolus.

Stein (16) reported a case in 1930, of a boy who was first seen at the age of one week, because of vomiting and inability to gain weight. The mother was normal, but the patient was her first child and the delivery had been instrumental. So far as the history could be obtained, there had been no cyanosis or dyspnea at birth.

Physical examination at the age of one week showed a normal child except for the observations on the chest. Respiratory symptoms and cyanosis were absent. There was tympany over the entire right side of the chest, and voice and breath sounds were absent on this side. The heart was displaced to the left, the right border being at the midsternal line.

Fluoroscopic examination showed the entire right side of the chest to be filled with air, the heart pushed over to the left, and what appeared to be the right lung situated at the root. A barium meal was given to rule out diaphragmatic hernia and eventration. It showed the stomach below the diaphragm on the left side and corroborated the previous observations.

At two years, the child was physically small for his age, and showed the characteristic pigeon-like deformity of the chest. He had had several attacks of bronchitis without undue consequences. At no time had he suffered from attacks of cyanosis or dyspnea. Fluoroscopy had been performed many times during his two years of life, with no change in the picture. At no time had there been any apparent absorption of the air. Possible etiologic factors had not become evident. The tuberculin reaction had been negative up to 5 mg. A bronchial fistula, however, could not be eliminated as contribution to the phenomenon. There had never been any evidence of infection.

Professor J. van Ebbenhorst Tengbergen

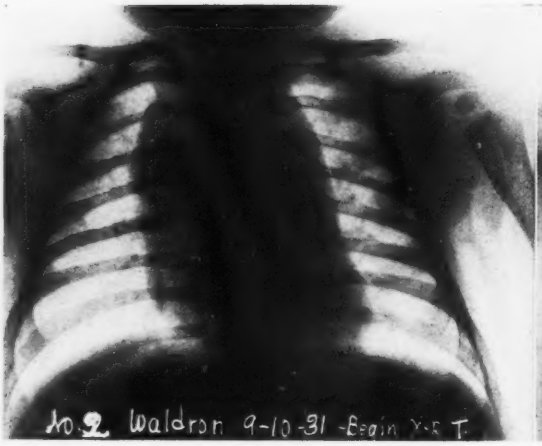


Fig. 5.

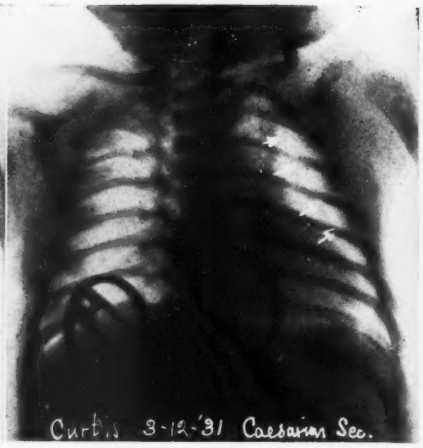


Fig. 6.

Fig. 5. Case 3. Film made three and one-half months after the film shown in Figure 4, Case 3, showing the right lung completely expanded and a marked enlargement of the thymus gland.

Fig. 6. Case 4. Showing partial collapse of the left lung with a small area of pneumothorax in the lateral portion of the left pleural cavity (one day old).

(17), within a period of three months, observed three pneumothorax cases in the newborn.

Case 1. A female child who, five days after birth, on Sept. 4, 1935, was brought to the Department because her color changed from red to blue and then became dyspneic. The physical investigation showed the heart sounds louder on the right than on the left, and percussion on the right side was dull. Clinically, it was thought to be dextrocardia. The roentgenogram made on September 4 showed displacement of the heart and mediastinal tissues entirely to the right. On the left side, there was a complete pneumothorax, excepting for an area of atelectasis.

The child, weighing 4,230 gm., was born spontaneously. She was not asphyxiated and had not cried abnormally. The birth was not prolonged, covering a period of approximately six hours. It was the mother's first child. The only special concern was the umbilical cord circling the neck once. Directly after birth, the child had a bluish appearance, with a white nose, and slightly cyanotic hands and feet. She did not cry normally, and the breathing was labored. The temperature was 37.2° C., and the child sweated profusely. On the third of September, her temperature had risen to 39.6° C., with increased dyspnea. This led to the roentgenographic examination. On the fifth of September, the temperature had returned to normal, and a new roentgenographic examination was made. This showed that the air in the pleural cavity had, in great part, been absorbed. On the ninth of September, the child was again well; she showed no cyanosis, her breathing was normal, she took nourishment normally, and her temperature was normal. The third roentgenogram, on this day, showed nothing left of the pneumothorax.

Case 2. A male child, born on Oct. 29, 1935, was seen, whose birth had been normal, the only condition being that the umbilical cord was wrapped around the neck once. The child was not dyspneic or cyanotic. However, instead of crying normally, he only whined somewhat painfully. Temperature was 37° C.; pulse, 120; respiration, 68. The physical investigation on October 30, the day after birth, showed the heart not percussible. The heart sounds were weak and difficult to hear. The breast bone was projected forward;

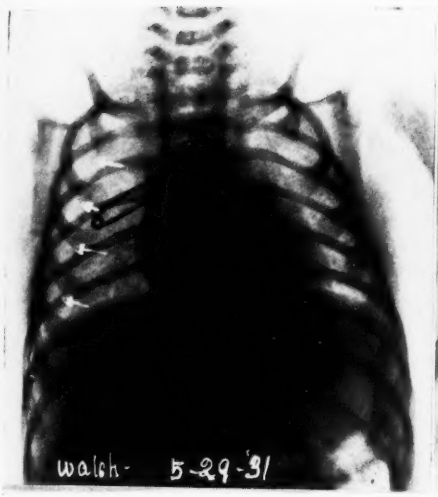


Fig. 7.

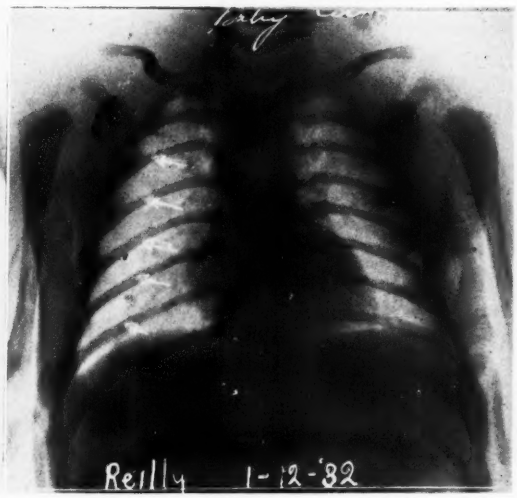


Fig. 8.

Fig. 7. Case 5. Showing an area of pneumothorax in the outer third of the right pleural cavity (nine days old).

Fig. 8. Case 6. Showing partial collapse of the right lung with an area of pneumothorax in the lateral portion of the right pleural cavity (one day old).

auscultation was normal. The roentgen examination in this case also showed on the left side an extensive pneumothorax, occupying the anterior portion of the chest. While in the former case the air was quickly absorbed, in this case likewise there was no air demonstrable within two days, and nothing else abnormal was shown.

Case 3. Female child, born Nov. 28, 1935, whose birth was normal excepting that the umbilical cord was wrapped twice around the neck. The child was born asphyxiated and had inhaled meconium. The weight was 3,930 gm. The therapy was changing baths, hot and cold. Examination, made at nine o'clock in the morning, showed an absence of heart sounds excepting in the epigastrium. No cyanosis or dyspnea was present. The child had a whining instead of a normal cry. She was, therefore, sent immediately for roentgenographic examination during the earliest hours after birth. Here likewise a small pneumothorax was found but this time on the right side, and also a very broad mediastinum, indicating an enlargement of the thymus.

Other reported cases referred to by van Ebbenhorst Tengbergen are as follows:

Quispel (18) described a case of spontaneous pneumothorax in a child of eight months. A few weeks later, this child died of tuberculosis. The cause of death here was clear.

Tideström (19) added a case found three months after birth. The pneumothorax was not absorbed. The cause was unknown.

Weiner (20) reported a case of pneumothorax diagnosed 14 days after birth. When the child died four and one-half months after birth, pneumothorax was still present. Section showed a large communication through an open bronchus. Cause undoubtedly was a congenital malformation.

Bush (21) described a pneumothorax discovered 32 hours after birth, which disappeared after pleural puncturing. The cause was unknown.

Emmert (22) described a case of pneumothorax which was found at autopsy. The child was born asphyxiated although it had breathed superficially and irregularly. Forced respiration was instituted,

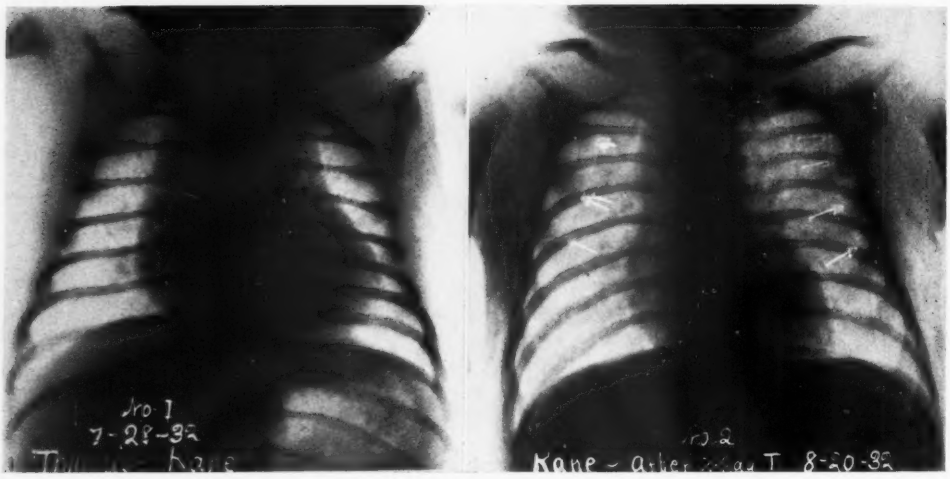


Fig. 9. Fig. 10.

Fig. 9. Case 7. Showing an enlarged thymus; lung-fields normal in appearance (one day old).
Fig. 10. Case 7. Film made after treatment of the thymus, showing reduction of the gland, but there are small areas of pneumothorax in the lateral aspect of both pleural cavities. X-ray examination made 24 days after Figure 9, Case 7.

shortly after which the child died. The section showed both lungs non-expanded. On the left side there was a pneumothorax.

Tollkuhn (23) described a case of right-sided pneumothorax in a child of normal birth. The child died after 24 hours; the cause was unknown.

Deissler (24) described a case in which the child died one-half hour after a forceps delivery. Section showed both lungs to be collapsed. Bilateral pneumothorax. Cause: localized emphysematous blebs, perhaps traumatic in origin.

Gasul and Singer (25) write concerning a pneumothorax discovered three weeks after birth, with compression pneumothorax on the right side. Three days later, the child died. Sections showed rupture of a subpleural abscess. Cause: infectious pneumonia.

Hotz (26) found, five days after normal birth, a right-sided pneumothorax. On the twelfth day, this was absorbed, but then a pneumothorax was shown on the left, which also disappeared several days later. Cause was unknown.

Hotz described a normal birth, five days after which there was a left-sided pneumothorax; after 17 days, it had spontaneously healed. Cause was unknown.

Hotz also described a normal birth, fifteen days after which there occurred a pneumothorax with collapse of the lung, which healed spontaneously.

Willi described a pneumothorax on the left side, after a normal birth, with umbilical cord encircling, associated with displacement of the mediastinal tissues. There was no absorption of pneumothorax. The condition persisted two years afterward.

Willi also described a pneumothorax on the left side, which was first discovered after three months, showing no absorption. It was still demonstrated one year later.

Glaser and Landau (28) discovered a case of left-sided pneumothorax three weeks after birth. Five days later, the child died. Section showed a perforated abscess.

Following is a report of the seven cases observed by us during the four-year period, from 1928 to 1932:[1]

Case 1. Fahey, female, a first child, weighing 8 pounds and 1 ounce, who was

[1] During this period x-ray examination of the newborn chests was routinely made.

born spontaneously on Jan. 11, 1929. On the eighth day, the baby developed a temperature of 103° F., and on the third day, it rose to 105° F. There was a definite cyanosis noted, and a raspy cry. A clinical diagnosis of bronchopneumonia was made. The temperature continued for six days between 100° F. and 105° F. On January 21, an x-ray examination of the chest was made, which showed a collapse of the right lung to about two-thirds of its normal size, with an area of pneumothorax in the outer one-third of the right pleural cavity. The heart and thymus were not enlarged, and there was no fluid noted in either pleural cavity (Fig. 1, Case 1). The following day, a second film was made because of this unusual finding and to make certain that the diagnosis of spontaneous pneumothorax was correct. This film also showed the area of pneumothorax (Fig. 2, Case 1). This baby was definitely cyanotic at the time of the x-ray study, but was discharged as improved on January 24. The child finally made a complete recovery, and no further x-ray studies were made.

Case 2. Peters, male, was delivered normally and spontaneously, on Nov. 11, 1930. At birth, the baby was quite cyanotic in both skin and mucous membranes. A loud blowing systolic murmur was heard over the heart area, and a diagnosis of congenital heart disease probably patulous foramen ovale, was made by our cardiologist. On November 19, an x-ray examination of the chest was requested. This showed no enlargement of the heart or thymus, but there was a partial collapse of the right lung with an area of pneumothorax in the outer one-third of the right pleural cavity (Fig. 3, Case 2). Mother and child were discharged on November 21 and referred to the family physician. On Jan. 7, 1931, at 2:30 A.M., the baby was brought into the hospital because of marked cyanosis and gasping for breath. The mother said the child had been doing well except that he became slightly blue at times. Physical examination at this time showed the baby quite cyanotic, with rapid, labored breathing. Bronchial breath sounds were heard throughout, and a flat note to percussion over both lungs. It was impossible to hear the heart sounds clearly because of the harsh, loud breathing. A clinical diagnosis of bilateral bronchopneumonia was made, complicated by congenital heart disease and partial atelectasis of the right lung. The temperature was 105° F.; pulse, 180; respirations, 76. Active treatment was continued throughout the day, and oxygen was used at frequent intervals, but the baby died that same day. No x-ray examination was made and autopsy was refused.

Case 3. Waldron, eight-pound boy, born May 8, 1931; at birth low forceps were used and labor was not difficult. The chest was x-rayed on May 20 because of slight cyanosis. This showed partial collapse of the right lung with an area of pneumothorax 1 by 4 cm. in the lower outer portion of the right pleural cavity. There was no evidence of disease in the lungs or pleura; the heart and thymus were not enlarged (Fig. 4, Case 3). Mother and baby were discharged in good condition on May 23. On Sept. 10, 1931, at the age of four months, the baby was sent back to the x-ray department for chest examination because of cyanosis. This showed both lungs well expanded, no evidence of pneumothorax, but definite and marked enlargement of the thymus gland (Fig. 5, Case 3). The thymus was treated by x-ray and a final film was made November 12, which showed the thymus reduced to normal size, and the heart and lungs normal in appearance. The cyanosis had completely disappeared.

Case 4. Curtis, female, was born on March 11, 1931, by Cæsarean section because of previous difficult high forceps extraction. Mother and child left the operating room in fairly good condition. Baby was tongue-tied and regurgitated after nursing and became slightly cyanotic. Was referred to the x-ray department on March 12 for examination of the chest for possible enlarged thymus or atelectasis. The film showed partial collapse of the left lung, with an area of pneumothorax about

three-fourths inch in width, in the outer upper left pleural cavity. The thymus was not enlarged, the lungs showed no disease, and there was no evidence of fluid in either pleural cavity (Fig. 6, Case 4). Mother and child were discharged in good condition on March 25.

Case 5. Walsh, male, was born on May 20, 1931. The mother was a primipara, and had a very difficult forceps delivery. The child did not breath normally for five minutes; mother and child, however, left the delivery room in good condition. There was a large swelling (caput) on the left side of the baby's head. On May 29, the baby was sent to the x-ray department for examination of the head and chest. Films of the head showed slight depression of the left parietal bone beneath the local swelling in the scalp, but there was no definite evidence of fracture. A film of the chest showed partial collapse of the right lung with an area of pneumothorax in the outer third of the right pleural cavity; there was no evidence of fracture in the chest. Neither the heart nor thymus was enlarged (Fig. 7, Case 5). Both mother and child were discharged in good condition on June 3, 1931.

Case 6. Reilly, female, born Jan. 11, 1932, was a first child. Position left occipito-anterior. Under gas anesthesia, an episiotomy was done because of a rigid perineum: Simpson forceps were used. The baby breathed immediately; mother and child left the delivery room in good condition. The general appearance of the baby was good. No asphyxia, skin was pink, slight moulding of the head, and her weight was 8 pounds and 1 ounce. On January 12, she was referred to the x-ray department for possible enlargement of the thymus. The film showed none but there was an area of pneumothorax, occupying the outer third of the right pleural cavity, with partial collapse of the right lung (Fig. 8, Case 6). The infant was discharged in good condition, on Jan. 22, 1932.

Case 7. Kane, male, a third child, whose birth, on July 27, 1932, was spontaneous. A small amount of ether was given during the last stage of labor. Position was right occipito-anterior. There was a slight first degree laceration. Mother and child left the delivery room in good condition. The baby weighed 8 pounds, 11 ounces. The skin was pink and clear, no asphyxia, and his head showed slight moulding and small caput. Physical examination otherwise was negative. X-ray examination of the chest, made on July 28, showed a moderate enlargement of the thymus. The lungs were well expanded, and the heart was not enlarged or displaced. Films of the skull showed no evidence of fracture (Fig. 9, Case 7). The baby, however, developed twitching of the arms, and a neurologic consultation was obtained July 30, on the third day. This revealed rhythmical contractions of both upper limbs, chest and neck, and at times also of the lower limbs. The contractions were more marked on the right than on the left side. The twitchings improved after the withdrawal of 3 c.c. of bloody spinal fluid. A diagnosis of intracranial hemorrhage was made. Four doses of x-ray were given at weekly intervals for the enlarged thymus. An x-ray examination of the chest was again made on August 20, which showed the thymus reduced to normal size, but there was a partial collapse of both lungs, with a small area of pneumothorax in the outer upper portion of both pleural cavities. The heart was not displaced and there was no evidence of fluid in either pleural cavity (Fig. 10, Case 7). In March, 1933, following bronchopneumonia, a film of the chest showed a mottled opacity involving the middle third of the right lung area, suggesting residual pneumonia rather than fluid. The left lung was well expanded and clear. This baby was treated in the neurological clinic for convulsions until April, 1933, when he was transferred to another hospital.

## SUMMARY

Seven cases of pneumothorax in the newborn were encountered by us in the x-ray department of the Misericordia Hos-

pital from 1928 to 1932, six of these before the twelfth day, and one on the twenty-fourth day. There were four males and three females; three spontaneous deliveries, three forceps, and one Cæsarean section. Only one of the forceps cases could be considered a difficult delivery. Four of these cases were definitely cyanotic at birth. There was no mention in our cases of the cord encircling the neck, as was noted in the cases reported by van Ebbenhorst Tengbergen. Normal breathing occurred immediately in six of the cases, and it required about five minutes to establish normal breathing in only one case. It, therefore, seems unlikely that the method of delivery has anything to do with the causation of pneumothorax, but perhaps it occurs during the first inspiratory or expiratory efforts, especially when some secretion or substance enters the larynx during or immediately after birth, causing a spasm of the epiglottis under these conditions. It seems probable that rough handling, especially to the chest, in establishing normal breathing could cause a rupture through the alveoli and pleura, such as must occur in the formation of pneumothorax. The degree of collapse and the amount of air present are dependent upon the size of the rupture. No fluid (blood) was demonstrated in any of our cases, but a very small amount might have been overlooked, all of the films having been made in the supine position. More careful study and detailed observations of the newborn during and immediately after delivery are necessary to determine more definitely the manner in which pneumothorax is produced.

Practically all of the uncomplicated reported cases, including our own, recovered spontaneously in a few days, and only those cases complicated by pneumonia, abscess or congenital anomaly of the lung and pleura terminated fatally. We are convinced that many more cases of pneumothorax in the newborn would be recognized if routine chest x-ray examinations were made immediately after birth or as soon thereafter as practical.

54th and Cedar Ave.

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# MADELUNG'S DEFORMITY OF THE WRIST

WITH REPORT OF A CASE

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MADELUNG'S deformity of the wrist is a rare condition, usually bilateral, developing at the distal end of the forearm of young individuals between the ages of 8 and 20 years—80 per cent of such deformities appear between the ages of 11 and 15 years. The deformity is essentially an anterolateral curvature of the distal third of the radius, with dorsal prominence of the joint end of the ulna. Contrary to early descriptions, it is not associated with an irreducible dislocation of the wrist. The lesion progresses slowly and by the end of one or two years the deformity is complete. During the active developmental stage, pains may or may not be present. If there is discomfort from pain or ache, it may be aggravated by forced movement, chiefly by extension.

The anatomical changes are best seen in roentgenograms which include the hand and the entire forearm. There is bowing of the lower third of the radius, usually dorsal and lateral. The articular surface is tilted medially toward the volar side and slightly rotated inward and backward, and the carpus is thrown forward. The increase of the axial curve of the radius, especially along its medial aspect, results in marked bowing with shortening of the length of the bone. The ulna is not primarily affected, but, due to the shortening of the radius, the distal joint end of the ulna is made to override the carpus and it becomes unduly prominent, as is demonstrated in lateral views. In 96 per cent of the cases this overriding takes place dorsally and the carpus is displaced anteriorly. Rarely, as in Stetten's case, the reverse occurs. The relative overgrowth of the ulna is of the greatest importance and very often gives rise to the first clinical manifestation of the deformity.

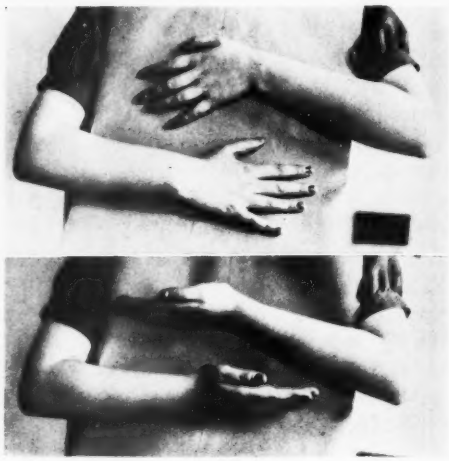

Fig. 1.

Especially characteristic is the widening of the interosseous space due to the exaggeration of the normal flexor concavity of the distal end of the radius. The arrangement of the carpal bones presents more or less alteration, chiefly as regards the static relationship between the distal end of the forearm and the proximal carpal series, while the individual bones mostly remain normal in shape and outline. Schnek and Melchior have drawn attention to more or less marked changes in the declination angle of the joint surface of the radius with a corresponding pyramidal arrangement of the proximal carpal bones (Figs. 1 and 2). Köhler points out that instead of the normal slightly curved arrangement of the carpals, paralleling the joint fork of the forearm, there is a V-shaped arrangement with the os lunatum forming the vertex of the triangle. This is mainly observed in cases of bilateral true Madelung's deformity.

Recent papers have confirmed this finding and have further pointed out the presence of low-grade changes of a similar nature in the contralateral joint in cases in which clinically the deformity was only unilaterally manifest. Only occasionally are there changes of the joint surfaces of the proximal carpals or of the intercarpal joint spaces. Roentgenologically, the alteration of the plane of the joint surface of the radius produces a console-like appearance of the facet of the radius, although the outline of the articular surface appears scalloped. By such transformation a rather triangular arrangement of the carpal bones may result. One of us has observed a similar static deviation whereby the arrangement of the wrist bones presented the above-described triangle in a lesser degree and without clinical symptoms in several cases as an incidental finding. Such findings may easily be confirmed when the attention of the roentgenologist is called to static relations of the radio-ulnar-carpal articulation. We, therefore, feel that, besides clinically manifest Madelung's deformity, there occur instances of incomplete and latent deformities.

Madelung's deformity is, in its classic form, unmistakable and presents the appearance of a subluxation of the wrist with the dorsally prominent ulna and the radius bent or curved forward and toward the ulna. On inspection, the ulnar prominence is seen to be accentuated; there is a "silver-fork" deformity, and extension and circumduction are limited at the wrist. In the posterior form, flexion is limited. Generally there is a moderate limitation of abduction, and there may or may not be limitation of pronation. Pahl and Fick state that limitation of the normal function is only a matter of degree. As Campbell points out, the dorsally prominent ulna may be pressed down to a level with the radius, but, immediately on releasing the pressure, it returns to its former position. This is probably due to laxity of the distal radio-ulnar ligaments. There seems to be little loss of function following the cessation of the active process; however, in certain instances the wrist is weakened and the disability progresses. Schnek and Bsteh report cases associated with fractures of the radius and of the os naviculare, and also with perilunar dislocation of the carpus, which might be consistent with decreased ability to resist trauma.

As early as 1825, Bégin noted forward dislocation of the wrist of laborers using heavy press levers. These men reported little or no discomfort, and Bégin attributed the deformity to occupational stretching of the ligaments. In 1839, Dupuytren mentioned a similar deformity and in the following year Lasanagie described a "luxation consécutive de l'articulation radio-carpienne." The first positive report, however, of the condition as we know it, was that of Malgaigne, in 1855. Other cases, probably falling into the same category, have been mentioned by Busch (1864) and Jean (1865).

In 1878, before the Seventh German Surgical Congress, Madelung described the dissection of a unilateral wrist deformity which he had encountered at an autopsy of a 20-year-old female, and mentioned 12 other similar cases which he had seen. The main features, as described by him, were lateral and dorsal bowing of the lower end of the radius, with volar inclination of the distal radial articular surface and apparent forward subluxation of the carpus. He found that the dorsal edge of the distal end of the ulna was prominent and well preserved, while the palmar edge was atrophic.

Since Madelung's report the deformity has been associated with his name, and has received considerable attention in the German, French, and Italian literature. In French, the deformity is known as the Madelung-Dupuytren or Madelung-Duplay's subluxation. In 1908, Siegrist collected 62 cases, only 10 of which were males. It was not until 1908 that the first paper dealing with the deformity appeared in an English journal (Brinsmade). The following year Stetten, in reporting a rare form of this condition, thoroughly reviewed the subject in a comprehensive article which

Fig. 2.

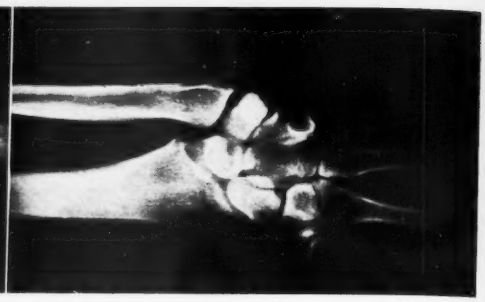

Fig. 3.

included a very complete bibliography. He summarized the reports of 62 cases of the usual anterior deformity and two (including his own) of the rare posterior type. The following year Stokes added two more, and, in reviewing the literature since that time, we are able to bring the number of reported cases of Madelung's deformity to about one hundred. Though probably not so rare in this country as the literature would indicate, it is nevertheless very uncommon; in the material of the New York Hospital but one case was noted in 25,000 examinations. It can be assumed that with the increasing number of examinations which are resulting from the Workmen's Compensation Act, and with the wider use of roentgen examinations in traumatic surgery, there will be more observations and reports of the condition.

Of 73 cases in which the clinical data were reported, 86 per cent occurred in females. The age of onset varied from 8 to 23 years, but in a large majority it was between the ages of 11 and 15 years, *i.e.*, at the time of puberty. As to the actual cause of the deformity, there has been much diversity of opinions. Occupational stretching with resulting relaxation of the ligaments, strain on the wrist during the growth period, muscle contractures, infantile and adolescent rickets, heredity, congenital syphilis with osteochondritic lesions, osteitis fibrosa, and endogenous disturbance of the bony-cartilaginous development have all been suggested. The conception that the deformity is a result of endogenous disturbance is strengthened by the frequency of bilateral deformity, either complete or silent, by the localization of the primary lesion in the epiphyseal zone of the radius, by the often observed associated underdevelopment of the entire forearm, and by the poor results following an operative elimination of the function of the flexor muscles. Some authors regard this condition as a congenital deformity and suggest that first attention to it is directed only at an age when strain on the part and constitutional changes due to malnutrition exert their influence.

Cases have been reported in which there have been associated other anomalies: homolateral cervical rib (Kayon), sacralization of the fifth lumbar vertebra (Ingber), multiple osteogenic exostoses (Gadrat), and congenital dislocation of the hip. Donovan and Racanski have reported cases simulating a Madelung's deformity following bone injuries in early childhood. These cases should be considered as secondary static deviations following disturbance of the normal fracture healing, and they do not represent the true Madelung's deformity. And so Fick, Zeitlin, Bertoletti, Czerny, and Delbet distinguish between a true and false Madelung's deformity. Springer suggests the term "secondary fork-hand" and reports cases as "*manus furca post fracturam, post subluxationem, e distorsione.*" There have been reports that polyarthritis, rheumatoid infections, osteomyelitis, bland inflammatory conditions, and toxic involvement of the

Fig. 4.

Fig. 5.

joint have produced such a secondary deformity.

## CASE REPORT

L. R., No. 62,957, a 16-year old native-born Russian Jewish school girl, was admitted to the Surgical Service of Dr. George Heuer, New York Hospital, April 27, 1934, for thyroidectomy. In addition to her history of goiter, she stated that at about the age of nine years she began to have "growing pains" in both wrists, which were especially noticeable on motion. These pains gradually subsided after a period of about two years, and her parents noticed a deformity in both wrists which was most marked on the right side. There has been no change for the past four years, the joints are no longer painful, and there have been no other symptoms referable to the wrists.

Examination of both forearms shows bilateral deformities of the wrist (Fig. 1), more marked on the right side. The ulnar prominence is exaggerated on both sides, and the carpus appears dislocated anteriorly. Just above the wrist there is a slight volar concavity of the radius, which appears bowed dorsally and laterally. The styloid process of the ulna is unusually prominent and appears dislocated posteriorly. Both extension and abduction are limited. There is no tenderness.

X-ray examination of the right wrist reveals the carpus to be projected anteriorly but not actually dislocated (Figs. 2 and 3). The distal end of the ulna projects dorsally, overriding the carpus, but the form and structure of this bone show no variation from the normal. The distal articular surface of the radius is inclined in a medial and volar direction, and is scalloped in outline. There is a small hyperostosis at the medial edge of the radial articular surface. The inner border of this bone appears shortened, and the proximal outline of the carpus presents a pyromidal contour in the anteroposterior view (Fig. 6-*A*) instead of the normal curved arrangement (Fig. 6-*B*). The individual bones show no changes in contour or structure. There is some condensation about the dorsal edge of the radial articular surface.

Roentgenograms of the left wrist show a similar appearance of the carpus and of the articular surface of the ulna, but in a lesser degree (Figs. 4 and 5).

## DISCUSSION

The reported case represents the final appearance of a true bilateral Madelung's deformity. Clinical and roentgenologic findings suggest that we are dealing with a primary lesion about the epiphyseal zone of the distal end of the radius, which later, due to disturbance of the normal growth process of the articular end of the bone, has produced, secondarily, a deformity of all the adjacent skeletal parts. While the anatomical deviation, although not a true dislocation in these cases, reminds one of the basic features of habitual dislocation of the shoulder and of the patella, the anatomical lesions at the wrist joint present an

appearance similar to that seen in the end-stages of other well-known growth disturbances, such as Perthes-Legg-Calvé's,

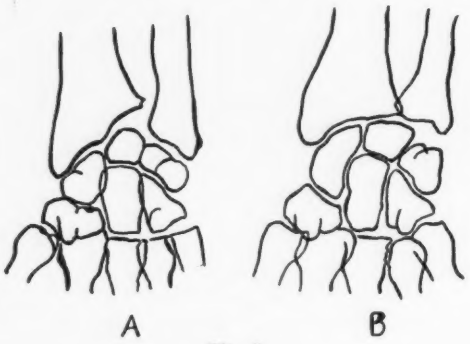


Fig. 6.

Köhler's, Osgood-Schlatter's, and Scheuermann's diseases. It is the opinion of the authors that, besides local disturbances of enchondral ossification, *i.e.*, replacement of cartilaginous by osteoid tissue, whatever this may be due to, likewise in cases of Madelung's deformity, a dysplastic malacia develops and probably produces histologic lesions at the epiphyseal zone similar to that seen in "local necrosis." Because of this there is inability to withstand mechanical strain, which eventually leads to a rearrangement of the anatomical relationship between the primarily involved radius and the adjacent ulna and carpals. It is altogether possible that in Madelung's deformity and in the previously mentioned diseases endocrine and constitutional disturbances may play a part in producing these conditions. It is of interest to note that our patient and one of those reported by Stokes were both suffering from hyperthyroidism. There are recent reports which deal with the possible relationship between endocrine disturbances and Madelung's deformity. While the results of careful endocrine and metabolic studies are not striking, there have been in a few cases variations from the normal. One of us had the opportunity of observing three cases, and in view of this experience we are inclined to agree with Stieda, Gickler, Redard, and Stetten that the deformity develops secondary to a lesion of the cartilage of the distal radial epiphysis, with subsequent disturbance of growth at this point. We feel that in the cases of true Madelung's deformity, a mechanical cause consisting in a single injury or frequent repeated minor accidents constitute the primary cause of the initial lesion. The abnormal reaction of the bone to trauma is possibly due to endocrine and constitutional disturbances affecting the bony-cartilaginous growth. This seems to us a satisfactory explanation for the development of a deformity of the radius in the presence of a normal ulna and normal carpal bones.

## SUMMARY

(1) A case of Madelung's deformity of the wrist is reported.

(2) The clinical and roentgenologic findings are noted.

(3) The etiologic and predisposing factors are discussed.

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# SOME LAWSUITS I HAVE MET AND SOME OF THE LESSONS TO BE LEARNED FROM THEM[1]

*(Eleventh Installment)*

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## OWNERSHIP OF ROENTGENOGRAMS

WHILE the question of the ownership of roentgenograms appears to be fairly well settled and established by the two Michigan District Court decisions[2] and the recent Michigan Supreme Court decision which will be mentioned later, it may be found useful and instructive for us to handle similar situations. We will recite some of the particulars of a suit.

Twelve years ago, a radiologist in a neighboring city wrote me: "I am being sued for possession of films taken of a patient.

"This suit is preliminary to a suit for malpractice, to be filed against the patient's attending physician, and the patient's attorney is evidently desirous of obtaining possession of the films for reasons best known to themselves.

"They make the same old stipulation that these films are wrongfully in my possession, as his [the patient's attorney's] client has paid for them and that they are therefore his property. . . .

"I shall appreciate it if you can inform me of previous decisions rendered in test cases."

I replied: "Replying to your query of yesterday, will say that I have at this time no knowledge as to any definite decision from a court of record regarding the ownership of roentgenograms as such; but I have defended the position that roentgenograms are records of examinations and that as such records, they are the property of the radiologist who made them, or of the institution where they were made. Some three or four years ago, I introduced resolutions, which were passed by the Radiological Society of North America, that 'It is the sense and judgment of this Society that all roentgenograms, plates, films, negatives, photographs, tracings or other records of examinations are hereby declared to be the exclusive property of the radiologist who made them or of the laboratory where they were made.'

"Now then, the law is very strict that physicians must follow established modes of practice. Naturally this may be inferred to mean more than the treatment of disease, and if they depart from recognized methods of practice, they do so at their peril. Why cannot we carry this just a little bit farther and say that the accepted mode of practice is for roentgenologists to retain possession of the roentgenograms, which are a part of their records, and in failing to do so, they depart from established rules and methods and consequently make themselves liable?

"Again, it has been held by courts all over this country that the liability of physicians depends largely upon whether their practice in the case in question has been in agreement with the particular school of medicine which they practise. While radiology is of no special school, the methods followed by radiologists should be adjudged as regular if they follow the established methods of their specialty.

"I recently had a careful search made for decisions applying to this subject, by a very competent attorney. Under date of Feb. 14, 1924, he wrote to me that he and his associates had been unable to find any decision referring directly to this subject. He gave me the following, as an opinion: 'As to the ownership of an x-ray plate, this question has never been squarely passed

[1] The Editor desires to state that much of the matter herein has to be printed in form as received, without normal punctuation or phrasing.

[2] Two decisions, from the Circuit Court of Ingham County, Mich., and Genessee County, Mich., respectively. Published in RADIOLOGY for December, 1932, p. 395.

upon by a court of last resort, but it may be answered by analysis. The patient goes to a physician primarily for the diagnosis of a condition or for such treatment as may be indicated. The physician makes an examination, part of which consists of making a roentgenogram. If the roentgenogram is made by the physician himself, then the plate or film is a part of the record of that particular case. It is just as much a part of his examination as any instrument used, device or method employed. It would be unreasonable to contend that a patient owns a history sheet. It, nevertheless, is a part of the record of an examination, although it may contain the doctor's conclusion as to the result of the examination. The history sheet records the temperature, pulse rate and numerous other items, while the roentgenogram records some other items which refer to the findings, and which are just as much a part of the records of important items necessary for the correct diagnosis of the patient's condition as are the temperature, color of his skin, or whether his urine contains albumin or casts.

"'The patient pays for the physician's opinion, or, in other words, his examination and the possible treatment, not for the means by which these are determined. The patient does not pay for the x-ray plate any more than he does for the thermometer, stethoscope, or microscope which were used to determine his temperature, heart sounds, or the condition of his urine.

"'In the absence of a specific agreement, the roentgenogram belongs to the person who made it. This conclusion is borne out by analysis. Courts have consistently held that a prescription written by a physician does not belong to the patient for whom it was written. He does not pay for the prescription but for an opinion of his disorder and for treatment for the same. The prescription is nothing more than an order to the druggist to supply the patient with the medicine mentioned. The druggist fills the order and files it as his voucher or authority for supplying the drugs mentioned in the order. The situation is similar to that of writing a check on a bank. The check, of course, is not money. It is simply an order on the bank, as custodian of the depositor's money, to pay a certain amount of money to the holder of the check. Unless some specific agreement to the contrary is made, the roentgenogram belongs to the individual who made it.

"'An additional analogy is found in the question of the ownership of photographic negatives. A person goes to a photographic studio for a photograph, but he does not pay for the plate any more than he pays for the camera. The courts have repeatedly decided that the plates or negatives belong to the photographer, who is, however, required to put their use to proper purposes. The following court decisions depend upon the foregoing point: American Mutoscope Co., *vs.* Edison, 137 Fed. R., 262; Itzrovitch *vs.* Whittaker, 39 So. R., 499; Schulman *vs.* Whittaker, 39 So. R., 707; Burrows *et al. vs.* Sarony, 111 U. S. R., 53; Thornton *vs.* Schreiber, 124 U. S. R., 612; Hottinger *vs.* Jackson, 11 Queen's Bench Decisions, 627.'

"As you probably know, I have been pretty active on this particular subject for a long time. I read a paper upon it before a joint meeting of the Western Roentgen Society (the progenitor of the Radiological Society) in 1918, which was published in the 'Journal of Roentgenology' that year, and I introduced and had passed the resolutions mentioned in the early portion of this letter. Last March I presented a more exhaustive paper on the same subject, before the Milwaukee County (Wis.) Roentgen Society, which will be published in the 'Radiological Review'[3] soon.

"I do not know just how your Indiana law reads, but in Illinois, when I have refused to turn over roentgenograms, when lawsuits have come up for trial, I have been served with a *subpoena dueces tecum*, which orders me to bring all records, documents, and roentgenograms pertaining to the case, and I do not doubt but that your laws are about the same. As a matter of fact, there

[3] Radiological Review, May-June, 1925.

are numerous decisions from supreme courts, notably from Oklahoma, Iowa, Vermont, Texas, Virginia, and North Carolina, that roentgenograms may not be admitted in evidence unless they have been identified by the person who made them, and in three of these States (North Carolina, Virginia, and Oklahoma), the decisions state that the plates or films must have been constantly in the possession of the person who made them in order that they be admissible as evidence. In view of these facts, might it not be well, of course, with the knowledge and advice of the attorneys for your associate and yourself, that you freely surrender possession of the plates in question, with the idea of taking advantage of the points made in the decisions just quoted (or rather cited)?

"As far as I know, the bringing of this suit is probably the first of its kind, and I assure you that I am extremely interested in it. While I feel sorry for you and for your friend, I am frank to say that I am glad that this question is about to be tested and decided before a court of justice. If I can be of any use to you or to your friend, be assured that it will be a pleasure for me to aid in maintaining the position and opinion that I have held for over twenty years.

"Another important element which may have a weighty bearing in your case is the question as to how you rendered your bill for the services in which the roentgenograms were a part. Did you bill the patient for radiographic or roentgenographic *examinations?* If you did that, it will of itself maintain your position and contention; but if you billed the patient for roentgenograms or x-ray plates, it is up to you to deliver them. This is in conformity with an opinion of one of the best medico-legal lawyers in the United States. In his communication to me, regarding this subject, he wrote: 'If the proprietor of the roentgen laboratory is employed to make a diagnosis and his bill is rendered for diagnostic services, the plate or film presumably remains his own. If he has not been employed to make a diagnosis, but to make a plate, then the plate belongs to the person ordering it (*the referring physician*).'"

Several months later, my Indiana friend wrote: "I took your letter to the patient's attorney, who is also a personal friend of mine. He told me that the patient was shown your letter and that on his advice they [the patient] had best withdraw the replevin suit against me. This was done and I have heard nothing further since that time."

The foregoing is a recital of like proceedings known to the writer to have occurred not less than a dozen times since 1918, and until the epoch-making decisions from Michigan, previously mentioned, we have been unable to induce attorneys to push suits for possession of roentgenograms when we have been able to present our arguments. To cap the climax and make Michigan the pacemaker, in a suit for possession of roentgenograms which was carried to the Supreme Court of Michigan (McGarry *vs.* J. A. Mercer Co.), this highest court in that State last June (1935) decided in favor of the physician plaintiff and appealee that the roentgenograms in question belong to him. The decision has not been published at this writing.

Here is a victory upon which your writer feels he has had considerable influence. He acknowledges much aid in the work from Dr. Sam W. Donaldson, of Ann Arbor.

Dr. Philip King Brown, Supervisor of Medical Service in the Southern Pacific Hospital, at San Francisco, in a letter in the "Journal of the American Medical Association" of Feb. 1, 1936, discussed "The Ownership of X-ray Films." Among other things, he said: "If it were necessary to decide the question at once and finally, I should say that *since the profit in roentgenology is so great* [italics mine], it seems to me that the taker of the original film could supply a 4 by 6 photograph of the film or of such films as established the diagnosis, for passing on to the patient." In other words, this distinguished physician would have us become medical photographers, exactly what we have for nearly forty years been fighting to keep away from. And he

recommends exactly what we have many years ago declared to be unethical. I refer to the giving of prints, copies, or films to patients.

After more or less rambling argument pro and con the same writer states: "There are far too many roentgenologists and the poorer two-thirds ought to be prevented from claiming either the remuneration or the authority of the skilled ones, and this applies particularly to roentgen therapy." Perhaps the American Board of Radiology may help solve that portion of Dr. Brown's problem.

He concludes by saying: "It would seem, therefore, that it is the duty of some one in authority to have the courts settle all the problems connected with x-ray films of pathologic conditions for the benefit of the patient and the protection of the doctor." Evidently he has never heard of the Radiological Society, nor is he aware that that body fixed the status of the ownership of roentgenograms as long ago as Dec. 16, 1920, and that the recent court decisions in Michigan are the direct outcome of the Radiological Society's action. The writer knows this, because he wrote the Resolutions which were adopted at that meeting and has sent out approximately 160 reprints and letters regarding that particular subject to radiologists, attorneys, insurance companies, hospitals, industrial commissions, and the like. He has personally pleaded with attorneys and begged them to start legal actions to try to force him to yield possession of roentgenograms; but none would proceed, *because he knew that he could not win*.

Therefore, we still maintain that the roentgenograms belong to the radiologist or to the establishment where they are made, as a part of the record of examinations of patients, unless a specific contract to do otherwise than examine has been entered into. The courts are just beginning to recognize and acknowledge what we have known for a long time, and now comes a man, who from his own statement, "does not know what it is all about," and wants to have "some one in authority" decide for him. We—the Radiological Society—have decided, and are well satisfied with our decision after over fifteen years have passed since the passage of the Resolutions promulgating our decision (see page 84, 1935 Membership Roll of the Radiological Society of North America).

### HEMIPLEGIA AND HEMIANOPSIA

While by far the greater number of medical malpractice cases with which the writer has been connected and concerning which he has advised regarding the defense, were based on injuries resulting from the use of the roentgen rays, there has been a considerable number due to other causes. Among the latter group was one that was the source of a great deal of pleasure and gratification to me.

An attorney for a large insurance company called me over the telephone in 1929 and asked me, if, in my opinion, a facial, lingual, and internal ocular paralysis could be caused by an osteopathic treatment. I replied that I preferred to have more time to consider the question and possibly to consult neurologists and ophthalmologists before I expressed a definite opinion. I asked him to write me the full particulars and, upon receipt of same, I would give him the best that I knew or could find out. His letter read: "As *per* our telephone conversation in this case, the following is a résumé of the facts:

"The patient, H. S., an electrical engineer of 50, called at the office of our assured, complaining of neuritis in the shoulders and a general nervousness. The osteopath placed the patient on a table, lying on his side. While working on the patient's neck and head the patient developed a partial paralysis affecting his right side and also his right eye and tongue. Patient's mind was affected and he was only semi-conscious. The total incapacity lasted for about nine weeks. At the present time he is partially able to resume his duties.

"He is still suffering from lack of co-ordination and numbness in his whole right side. The doctors who have examined him

say that he has a permanent loss of the use of the outer quadrant of the right eye.

"The patient alleges that the injury was caused by turning his head too far to the side.

"We are anxious to know if such condition could result from an osteopathic treatment or whether this condition indicates some chronic condition that simply evidenced itself at the time of this treatment.

"The osteopath advises us that after the partial paralysis developed he took the patient's blood pressure, which he found to be 162 systolic.

"We will be pleased to have your opinion herein."

Three days later I wrote: "In reply to yours of June 21st *re* above-captioned case, will say that after carefully considering conditions, eliciting the opinions of two high-class neurologists and a high-class opathalmologist, correlating their opinions with what I know from my own experience and knowledge, I am firmly convinced that the hemiplegia and hemianopsia complained of by the plaintiff in the case in question, are *not* directly due to the alleged cervical spinal injury—'the result of turning his head too far to the side.'

"Neck injuries, such as are alleged, might and frequently do produce paralysis of one or both sides of the body *below the location or point of the injury; but they never affect the eyes*, and from our knowledge of human anatomy and physiology, *we know that they cannot affect the eyes.*

"It is comprehensible how the tongue might be affected, if the injury resulted in a closure (partial) of the jugular foramen in the base of the skull, whence the tenth, eleventh, and twelfth cranial nerves make their exit from the cranium; but if the tongue—which is innervated by the twelfth nerve—became paralyzed wholly or in part, due to an injury at this point or distal to it, there would *almost certainly and positively* be injury and paralysis of the functions of the tenth and eleventh nerves. The tenth nerve is the vagus or pneumogastric nerve, and has one of the widest distributions of any of the nerves in the inside of the body, while the eleventh nerve is the spinal accessory nerve and is an important nerve affecting motion. Also, none of these nerves has anything whatever to do with the eyes, and furthermore, *no nerve outside of the cranium has anything to do with the eyes nor with sight or vision.*

"Hemianopsia—which is the technical term for loss of vision in one-half of the eye or normal visual field—is usually caused by a lesion between the optic chiasm and the occipital cortex, a lesion in the cortical center controlling vision, or in the angular gyrus. All these are parts of the brain, and *are located within the cranium*, far removed from the neck, and could not by even the greatest stretch of imagination be affected by an injury to the neck, in a direct manner.

"The fact that the paralysis involved the right eye and the right side of the body points definitely and conclusively toward either an apoplexy or a thrombosis, *within the cranium and in the brain*, in the centers which control the right side. If the paralysis came on slowly, the cause would most likely have been a hemorrhage, due to the bursting of a blood vessel in the brain and pressure from the blood, in the region controlling these parts. If the paralysis came on suddenly, that would in all likelihood be due to the lodging of a blood clot or of some similar substance or tissue, at or near the same location.

"The blood pressure at 162 in a man of 50 is high enough to rather strongly suggest, if not to absolutely justify, a diagnosis of cerebral hemorrhage in this case.

"Incidentally, and entirely aside from the considerations herein discussed, a blood pressure of 162 should have been enough for the defendant to have been warned against applying his vigorous neck-twisting therapy. But being an osteopath, he had had no training in the significance of that, and *that is one more good reason why your company should not insure osteopaths.*[4]

"Now then, while we are satisfied that the alleged ailments are not and *can not* be

[4] Incidentally, this insurance company quit insuring osteopaths the next year after this letter was written.

due directly to the manipulations of the defendant, may it not be argued that the plaintiff, having high blood pressure, was more liable to have a cerebral hemorrhage, and that the severity of the manipulation was the drop in the bucket that caused it to overflow? I believe that is possible, and if the hemorrhage occurred soon after the defendant's manipulation, it is probable. So, while the alleged injury could not be a direct cause of the ailments that plaintiff claims, it might have been an exciting cause, because it precipitated a condition which was imminent, and would as likely have occurred if the plaintiff had stubbed his toe while walking, or incurred some similar slight harmless or otherwise innocuous accident.

"Similar events such as this occur frequently in the practice of medicine and surgery, and the patients have no recourse from the effect of proper treatment, provided the person administering the treatment is a properly licensed practitioner, exercising due care in the administration of the treatment. Physicians do not and are not expected to guarantee good results or good effects following their treatment. Physicians are not insurers of cures or even of benefit from their treatment.

"The foregoing embodies my opinion, and outlines something of a line of defense which can be proven by expert testimony, and which, it seems to me, should enable you to secure a verdict for the defendant."

The attorney for the insurance company replied as follows: "We are in receipt of your letter, giving us your report in the above captioned matter, for which we thank you. The report is very full and is very helpful and we want you to know that we appreciate it very much."

The case was settled for $1,500 out of court.

### PRACTISING MEDICINE WITHOUT A LICENSE

Several years ago I was asked to help an Eastern group in the prosecution of several men who were practising medicine without the necessary state license. I wrote: "Of course you know that you must catch your rabbit before you cook it. Likewise, you have to have a patient or—better—several patients, who have been treated by your culprits, and who have paid for the treatments. And it is to be preferred that these patients can show and prove that they did not have the ailments or disease that the irregular practitioners treated them for. Although this latter requirement is not absolutely essential, it is liable to help toward a conviction, because it shows the ignorance of the irregular practitioners. Of course, their ignorance has nothing whatever to do with their guilt of practising medicine without a license, but juries are peculiar 'critters,' and usually, some such thing as proof that the culprits took the money from the sufferers without giving them anything for it is considerably more liable to induce a conviction than without that kind of evidence, if you can get that sort of evidence into the record of the case.

"In furtherance of the proposition of prosecution of non-medical practitioners, your attention is called to a decision from the New Jersey Supreme Court, which seems to me might be of considerable value in at least one of the cases you mention.

"Chiropractors cannot legally use electricity in the treatment of patients according to the decision of the State Board of Medical Examiners *vs.* Harry De Baum. It seems that De Baum had been charged with practising medicine without a license, having treated a patient with some form of electricity and had been paid a fee for the treatment. The case was tried before a judge and without a jury, and the defendant was acquitted of the charges, in the First Judicial District Court. The State Board appealed the case to the State Supreme Court, which reversed the finding of the lower court (in Bergen County). The Supreme Court said: "Electricity is a dangerous instrumentality unless restrained within proper limitations, and its use as applied to the human body should be under the direction of authorized persons. Its use in the case for which the defendant was prosecuted was a part of the art of healing, and in no wise involved the function of

hand manipulation which, let it be said, is supposed to be the chiropractor's method of treatment." The Court further said: "This Court is unable to conceive of any hypothesis in this case on which the use of electricity in the manner stated is a part of the practice of chiropractic. The action of the defendant as stated is considered by this Court to be contrary to the prohibitory provisions of Section 10 of the act licensing physicians to practise medicine, enacted in 1921.

"The following are excerpts from some of the authorities, regarding what constitutes the practice of medicine.

" 'A physician is one lawfully engaged in the practice of medicine and includes all who practise physic or surgery and is not limited to any one school of practitioners.' (30 Cyc., 1544.)

" 'A surgeon may be said to be a physician who treats injuries, deformities, disorders. It would also include treatment of disfigurements or other physical conditions by manual operations and the use of surgical instruments and appliances.' (30 Cyc., 1546.)

" 'Liability under a statute prohibiting the practice of medicine without a license is not affected by the fact that the operations were performed and the medicines were administered under the direction and charge of a licensed physician and surgeon.' (30 Cyc., 1564.)

" 'The New York State statute regulating medical practice defines the practice of medicine as follows: 'A person practises medicine within the meaning of this article except as hereinafter stated, who holds himself out as being able to diagnose, treat, operate or prescribe for any human disease, pain, injury, deformity or physical condition, and who shall either offer or undertake by any means or methods to diagnose, treat, operate or prescribe for any human disease, pain, injury, deformity or physical condition. . . .

"The New York statute regulating medical practice applies to 'every means and method that could . . . be used or claimed to be used to relieve or cure disease and deformity, unless excepted by the statute.' (217 N. Y. Supp., 98.)

" 'Superfluous hair on the face is a deformity within the meaning of the New York State Public Health Law, and one who, not being a licensed and registered physician, holds himself out as being able to successfully treat such deformity and undertakes to treat it with an electric needle violates the statute regulating the practice of medicine, and under the statute is guilty of a misdemeanor and cannot recover for services rendered in giving such treatments.' (102 N. Y. Misc. R., 97.)

"The first three of the foregoing excerpts are recognized all over the United States, and should prove useful in the prosecution of your culprits. In addition to the foregoing I call your attention to the following citations, which you may have looked up if you feel as though you need them.

"The practice of medicine is defined in the following:

Loucks *vs.* Ionia Circuit Judge, a Michigan case. (151 N. W. R., 623.)

State *vs.* Yee Foo Lum, a Utah case. (147 Pac. R., 488.)

Commonwealth *vs.* De Lon, a Massachusetts case. (106 N. E. R., 846.)

Milling *vs.* State, a Texas case. (150 S. W. R., 434.)

Frank *et al. vs.* South *et al.*, a Kentucky case. (194 S. W. R., 375.)

Board of Examiners *vs.* Fregner, another Utah case. (154 Pac. R., 941.)

Swarts *vs.* Sveeny, a Rhode Island case. (85 Atl. R., 33.)

Commonwealth *vs.* Seibert, a Pennsylvania case. (105 Atl. R., 507.)

State Bd. of Exam. *vs.* Brown, a Colorado case. (198 Pac. R., 274.)

A North Carolina case; N. C. Supr. Ct. R., 1915, 33 Guilford.

Case 109, another Massachusetts case; 85 N. E. R., 858.

Andrus *vs.* State, another Texas case. (281 S. W. R., 851.)

Harris *vs.* State *ex rel.* Wilson, Solicitor, an Alabama case. (109 So. R., 290.)

State *vs.* Price, an Idaho case. (159 Pac. R., 1183.)

State Bd. of Med. Exam. *vs.* Fife *et al.*, a Louisiana case. (111 So. R., 58.)

William *vs.* Scudder, an Ohio case. (931 N. E. R., 481.)

People *vs.* Banks, a Michigan case. (209 N. W. R., 935.)

"An electrotherapeutist case, Larson *vs.* State (Texas). (285 S. W. R., 317.)

"I sincerely trust that you will find ample in the foregoing to show what you need to make those fellows behave. I would like to hear how you come out."

I never learned the result of the attempts to make these men quit practising medicine without being licensed.

### "MYRIADS OF PAPILLOMAS": AN UNUSUAL RESULT

The following letter to me, from a radiologist in a large Southern city, my reply, and his reply to me, all within the last week in 1924, tell an interesting and instructive story.

Dr. E.'s letter read: "I have been very much impressed by the articles you have written relative to expert testimony in cases pertaining to x-ray burns. At the present time I am going through the throes of such a distasteful experience, the case having come up once and resulting in a mistrial.

"To begin with, I want to give you the following history: In the Summer of 1920 a man came to my office with myriads of papillomas on each side of his face, and extending down into the bearded portion of his neck, and consulted me for treatment. He had had these warts removed a number of times by the electric needle, and they immediately returned, so I advised the only course that I knew—x-ray treatments. I gave him the following dose to each side: 8 in. distance; 1 mm. aluminium; 5 ma.; 9 in. S. G., for 5 minutes.

"The patient had to leave the city that night, and before he went I told him that I thought he might have some swelling in the parotid region as well as soreness in the glandular structure of the neck. Two days later he returned to my office, and complained of excessive dryness in his mouth and throat, which I naturally expected would follow the normal routine.

"Upon examination in the office of a laryngologist, he was found to have his mucosa, from the uvula downward, as white as cotton, and the laryngologist really thought it was a case of diphtheria. Of course I became very much alarmed, although I knew of nothing to do to stay the progress.

"Following this, a very marked edema of the glottis appeared and I for a time feared that we would have to do a tracheotomy; but this subsided to a sufficient degree to eliminate the necessity of such a step.

"Two or three days later the glands of the neck began to swell, and gradually reached the extent where the whole structural outline of his neck was in line from almost the tip of his chin to the angle of the jaw on each side, to the nape of his neck. I did not know what to do, of course expecting a horrible dermatitis to begin in the usual time, from ten days to two weeks after the treatment.

"At the expiration of three weeks there was nothing more than a blush on the skin, which gradually became deeper and more angry, and by the end of the fourth week I saw staring me in the face a definite x-ray burn. The glands of the neck remained in that condition for at least six months before any suggestion of retraction in the fibrous tissue accumulation manifested itself, and you can imagine what a horrible advertisement this was for me, being constantly on the street, and possessed of a vociferous personality.

"The dermatitis on the skin gradually subsided, after progressively reaching and going through the stage of ulceration, and I thought the matter was all over so far as danger was concerned.

"The patient in the meantime consulted Dr. B., at Johns Hopkins, Dr. J., at Philadelphia, and Dr. S., at New Orleans. He then came to my office and told me after the conference with the stated authorities that he realized he was the goat and could hardly attribute the unfortunate experi-

ence to me, but he expressed the desire for money. I knew that the poor fellow had been through a horrible experience, and having some insurance, felt that my insurance company would permit me, under the circumstances, to give him what he asked for, so I requested him to name the sum he wanted. He did so, and signed a release to that effect.

"Some time after this the patient went to Europe, being a German by birth, and on his return a little ulcer showed up on the site of the former irritation. His family physician, seeing the gravity of the situation, suggested that he go to Johns Hopkins, which he did. At that institution they removed the ulcerated tissue, which showed no evidence at all of malignancy, and dissected out the glands on that side of the neck. Following this operation the man had an extensive infection on that side of his neck, which almost caused his death. On his return from Johns Hopkins he entered suit against me on the grounds of fraud, claiming that I had mislead him into a compromise by saying that he was all right, and would have no further trouble, which, of course, is ridiculous, having had some fourteen years' experience in x-ray work previous to that time.

"Anyway, the suit was pushed, the jury was tied up in a six-to-six split, and at the present writing a rehearing will be had on the 5th of next January.

"The insurance company's lawyer, a very capable man, has been very much interested in your articles, and asked me the possibility of getting you to come here to assist in the present predicament.

"Will it be possible for you to lend your assistance on the date mentioned, should I wire you to come? My lawyer is trying to effect a compromise to, if possible, relieve me from the disagreeable and damaging advertisement that naturally follows.

"Please let me know immediately under what conditions you would come."

I replied: "After a hasty review of your account of the case I would say that about the only point against you is that the dosage you administered might be considered somewhat in excess; but with that taken into consideration the effect produced (as you relate it) was certainly very unusual, and was, in my opinion, evidence of marked idiosyncrasy to the effects of the roentgen rays, besides a very marked hypersensitiveness.

"With these things in mind, it seems to me the points that stand out as most vulnerable to attack are: first, marked idiosyncrasy to x-rays; second, the late appearance of the dermatitis—after three weeks—suggests to me the possibility of the patient having applied some drug after he had received the irradiation.

"The points which clearly are in your favor are: the treatment given was and is a recognized one for multiple papillomas; you settled in good faith with him and have a release, and the ulcer removed at Johns Hopkins Hospital was not malignant (*you should try to secure an affidavit to that effect*).

"In preparing this case, I would direct the attention of your attorneys to the following: Rost *vs.* Roberts (Wis.), 192 N. W. R., 38; Ferguson *vs.* Bellaire (Iowa), 197 N. W. R., 13; Hamilton *vs.* Harris (Texas), 223 S. W. R., 533. This last cited case is the second trial and second Supreme Court decision, and in this decision it is stated: 'He [meaning the radiologist] is not expected to anticipate results arising from the peculiar characteristics, etc., . . . nor is he an insurer of unexpected results.' Also, Antowill *vs.* Friedman (N. Y.), 188 N. Y. Supp., 777; Street *vs.* Hodgson (Md.), 115 Atl. R., 27; Stemens *vs.* Turner (Pa.), 117 Atl. R., 992; Hayes *vs.* Lufkin (Minn.), 179 N. W. R., 1007.

"I do not think that your case is nearly as bad from the standpoint of the defendant as was the Rost *vs.* Roberts case (192 N. W. R., 38), in which I appeared for the defendant and in which the verdict was for the defendant, and included a judgment of $550 for his services to the plaintiff. Just before the trial, the attorneys for the insurance company came to my office with long faces and told me that they had a bad one, but when they left, after planning

with me to go to the trial, they were decidedly more hopeful, and, as I just related, they won a verdict.

"While it does not sound well for a man to tout himself unnecessarily, we might as well recognize the value of my presence at a trial as an expert witness (as well as an advisor). As you probably know, I can qualify to the limit, having worked with the x-rays since 1896 and as a specialist in Chicago since 1907, specializing in therapy, as consultant for several hospitals, member of several x-ray societies, author of many papers upon radiological subjects, etc. Bringing these qualifications to a jury *must have some weight.* In addition to this, I know how to testify. I make my answers intelligible to the most ignorant man on the jury, explaining in detail whenever the opportunity presents, and generally succeed in convincing the judge and the jury that I know what I am talking about and that I am telling the truth. Right here it may be worth while to note that I have treated multiple warts (papillomas) with x-rays with good results. I treated one yesterday. It can probably be used, without bringing out that my technic was different from yours. As a matter of fact, I applied 6 ma. for 5 minutes, through 1 mm. aluminium, at 100 kvp., at 10 inches F.S.D.

"I wish I were so situated, Doctor, that I could afford to volunteer to come to B. without any expense to you; but as your insurance company will pay the bill, that need not deter you if you feel that you want and need my services. I can arrange so as to be there at the time of the trial and not be away any longer than is necessary, as the train schedules are most favorable for that. Of course, it will be necessary to know when you will want me, a day or two ahead, so that I can arrange my work here. My office work is almost altogether by appointment, many appointments being made weeks in advance, and when anything like this occurs, I send word to such patients, giving new dates. I would like to come and feel sure that it will be decidedly worth while for you and the insurance company.

"Trusting that this puts the subject in a definitely lucid and satisfactory basis, . . ."

Two days later I received the following: "It is with great pleasure and relief that I write you of the settlement that has taken place in my case. I have no doubt in the world that, from the testimony of both sides, I would have ultimately won, but the undesirable publicity attached to it, as well as the long-drawn-out contentious, exasperating experience, prompted me to follow my attorney's advice, and settle.

"The insurance company put up most of the money and I was taxed vastly less than I ever dreamed of. In fact, it was lighter than would have been my personal attorney's fee.

"I want you to know that I appreciate very much indeed your willingness to serve in the capacity you mentioned in your letter, and I am quite sure that the insurance company would have had you come if the case had come to trial.

"Your letter is indeed a most interesting one, and I shall keep it to use in case it might be of assistance to some other poor chap in this part of the country, in case you might not be able to come here."

The foregoing is an example of what occasionally happens. The writer has never seen so much that is unusual all occur in one patient; but the unexpected thing is liable to occur to any of us and if we can find a similar case or one nearly akin to it, we may find help, or at least moral support. It is exactly this sort of thing that has kept the writer on the trail of roentgen dermatitis malpractice suits, and by keeping in touch with all possible decisions from courts of last resort, he has in enough instances to make it interesting to himself and valuable to the other fellow been able to offer something constructive for the other fellow and destructive to the one claiming malpractice, or trying to get some of the doctor's hard earned money.

### ROENTGEN DERMATITIS FOLLOWING DIAGNOSTIC PROCEDURE

In 1922 a man named L. had a complete

gastro-intestinal examination consisting of two fluoroscopies of unknown duration and five roentgenograms. The roentgenologist, at that time a recent graduate in medicine, estimated the fluoroscopies to have totaled about 3.5 milliampere-minutes in duration, with 15 inches F.S.D., 4.5 inch S.G., and 1 mm. Al filter to the anterior abdominal wall, and about 7 milliampere-minutes to the dorsal region, with the same settings. The five films were made by using $1^3/_4$ sec., 30 ma., 5 in. S.G., 28 in. F.D., each with 1 mm. of aluminium filtration.

It was found—*after the trial*—that this same patient had had several roentgen examinations at a certain free dispensary where the x-ray work was done by a nurse technician and where no data were obtainable as to dates, time, etc.

Shortly after the examinations described in the preceding paragraph, the man developed a typical roentgen dermatitis, passing through the usual course and at the end of about two months presenting a typical third degree dermatitis. There was a deep ulcer in the lumbar region, containing three central islands of grayish-yellow slough, with angry over-riding edges, etc., so characteristic of the condition.

At this time the man was seen by one of our celebrated dermatologists, who prescribed a paste to be applied (which, incidentally, did about as much good as if the paste had been applied to the asphalt pavement in front of the hospital).

About three months after the advent of the dermatitis the man was moved to another hospital where his treatment consisted of making a complete excision of the damaged area, followed by skin grafting. The operation was most skilfully done by one of our best surgeons and resulted in a very satisfactory healing and termination of the condition.

At this time, a couple of lawyers who had heard about the case from a friend of the patient, visited the latter and had little difficulty in inducing him to allow them to start suit for malpractice, taking the case on a contingent fee basis, they to receive one-third of the amount of the damages awarded.

The case hung around in the courts for nearly five years, and when it did come up for trial the echoes of the Bloomington case (in which the doctrine of *res ipsa loquitur* was held to apply in all x-ray injuries resulting from diagnostic procedures) had not yet ceased reverberating, so the attorneys for the defendant advised settlement. This was accomplished for $1500.

The writer had been in conference with the defendant's attorneys in the hope and with the idea of helping in the defense, and was very much relieved to learn, just before the beginning of the trial, that it had been settled.

Here was an instance of the plaintiff having had roentgen examinations made both before and after those for which the defendant in the lawsuit had examined him, such unrecorded and unprovable examinations probably contributing largely to the injury (if not entirely being the cause). The young physician who made the examinations and who was later the defendant in the suit, had not questioned the patient as to whether he had had any previous roentgen exposures, and had consequently applied enough to produce the damage to an already insulted skin. It was a costly lesson to him, as he had no insurance, and he had to dig down deep into his pocket to pay the amount he settled for, in addition to his attorney's fees.

### PROMPT RECOVERIES OF PLAINTIFFS AFTER SUITS ARE SETTLED: HER "CASE WAS SETTLED YESTERDAY"

All those who have had any considerable amount of experience in the adjustment or settlement of claims for damages resulting from personal injuries have observed how rapidly the disabilities, lameness, limping, etc., for which the allegedly injured person has tried (usually with success) to collect damages, are healed, cured and entirely disappear as soon as the financial settlement has been made.

We have seen numerous most remarkable recoveries in instances in which patients (plaintiffs, we better say) required wheel chairs, crutches, jury masts and

similar apparatus, which have been discarded and cast aside almost before the ink of their signatures to the releases was dry.

The following is an example of this sort of thing, in which the most important testimony was against the presence of any injury, but wherein the defendant corporation chose to pay a considerable sum in settlement rather than run the risk of an unfavorable verdict.

A few years ago, a little, scrawny, slant-eyed woman of about 23 years of age was brought to me by an investigator for an attorney for examination of her lumbosacral and pelvic regions.

When she entered my office she limped considerably on her *left* leg and walked with a typical guarded spine gait. She was so shifty-eyed and fox-like in her conduct that I went into considerable detail in my physical examination of her, and her flippancy and impertinence became so extreme that it was disgusting to both my assistant and myself.

After disrobing, she pranced up to the x-ray table without any limp or guarded spine and flopped from dorsal to lateral position as though she was enjoying herself immensely. She hopped down from the high table and put on her clothes, all the while chattering like a parrot that had had a drink of hard liquor. But, *as soon as she had her clothes on she resumed her guarded spine gait and limped on her right leg as she went out.* Her conduct was so bad that it was good—a paradox, but you know what I mean.

My report to the attorney read, in effect, that the physical and roentgen examinations of his client's lower dorsal, lumbar, and sacral spine, pelvis, and thighs showed no deviation or departure from normal.

Not having discussed why this attorney had sent this woman to me for examination, I was considerably surprised to be called over the telephone a few days later by the attorney and informed that my services as an expert witness would be needed the next day, and that he was sending a formal subpoena for me but that I was to be paid as an expert by him, in the case of Miss R. *vs.* a certain corporation. This woman was suing the corporation for $25,000, alleging that she had received a spinal injury, and I found out later that she had imbibed several drinks with the *investigator for the corporation*, who had brought her to me for examination, and report to her own attorney. (I had mistaken the investigator for the corporation to be in the employ of the plaintiff's attorney.)

When I was put on the witness stand, qualified, had presented my films, interpreted them, identified the woman as the one whom I had examined and the direct examination was concluded, the defendant's attorney began a quiet and methodical but most searching cross-examination. He asked me about her gait, whether she appeared to be lame, if, in my opinion, she was really lame and disabled. All of my observations, naturally, brought out much that was damaging to the plaintiff's case. Re-direct examination brought out but little more and convinced me that the plaintiff's attorney did not understand my report or he would certainly not have called me as his witness.

Because of the allegation of injury and the likelihood of the jury giving a verdict for the plaintiff—in the face of such a poor showing being made by the plaintiff—the defendant corporation decided to settle this case. This was done immediately—out of court—after I had completed my testimony. Evidently they preferred to pay rather than risk it with the jury.

I met this young woman, coming into the building where I have my office, the day after the foregoing trial. She walked entirely without limp or guarded spine, as I well knew she could. I remarked to her that her "hip and spine appeared to be much better." Her reply was, "Oh, yes, my case was settled yesterday."

Perhaps I am a cynical old duffer, but I cannot help thinking that it is a crying shame for persons like this to be permitted to do this sort of thing. There was definite and conclusive evidence that the plaintiff

was neither lame nor injured. It is, as I have so often repeated, almost impossible for a corporation or rich litigant to secure justice in personal injury suits. The general idea appears to be that "they are rich; let us sting them."

AN INSTRUCTIVE FEE COLLECTION CASE

A well-known firm of high radiological authorities in the Southwest rendered services to the son of an attorney in another city in the same State, and failing to be paid their fee after a reasonable time, wrote a letter to the attorney. It elicited the following: "I have a bill from you for $35.00 for x-rays made of my little boy. My wife tells me that Dr. Q. sent her to you to have these made while she was visiting her sister in E. in July. Knowing nothing about such matters, my wife did as directed by Dr. Q. (*sic*). When I learned that he had directed her to have x-rays made I immediately wrote and asked her to see Dr. Q. and inform him that if I was supposed to pay for these x-rays, to send me the films as soon as they were ready, but Dr. Q. informed her that they never let the films go out. In my little practice I deal with x-rays frequently and the films are furnished to me on request. As the procedure of Dr. Q. developed, he did not impress me favorably and I advised him that his further service would not be desired, and requested his bill.

"The only value an x-ray would have been to me was to learn from physicians here on whose judgment I relied whether they revealed any disorder. Being refused the films at the only time they would have been of service to me, they have been of no value to me whatever. I feel this explanation is due you."

The radiologists immediately replied: "We have your letter of Sept. 7, and in reply will say for your information that your wife brought your little son to us, voluntarily, at Dr. Q.'s request, for an x-ray study of his abdomen. In making the entry in our case book Mrs. H. was asked by my secretary regarding payment for the service and was told to send the bill to you, and she was given your business address, to which our bill was promptly sent. Our terms for our service are strictly cash at the time the work is done, but we felt that you were good people, willing to do the right thing, and we did not wish to wound your feelings by holding up the work until your wife could communicate with you.

"When the work was finished we made our regular report to Dr. Q. We were never asked for a copy of the report or for copies of the original films. As an attorney you probably know that roentgenologists are required to keep the original films, because when they release them they have robbed themselves of the evidence on which they have based their opinion. Had you communicated with us we would have been only too glad to have furnished you with supplementary reports and with prints from the original films.

"As a member of the legal fraternity we feel sure that you realize that our time, services, and the material used in an examination represent our merchandise just the same as goods on a merchant's shelf, and when such goods are ordered the obligation is equally as binding.

"We are very sorry indeed that you have had a misunderstanding with Dr. Q. and that, because of this fact, you feel that you owe us nothing for our services; however, when you have thoroughly considered the matter we feel sure that you will be conscious of your obligation to us and will promptly discharge the same by sending us your check for the amount of our bill."

Not receiving a remittance after waiting a reasonable period, they (the radiologists) wrote to another attorney as follows: "Confirming our telephone conversation of a few days ago, I am sending you herewith an account of $35.00, properly attested, against F. D. H., of B. In order that you may better understand the attitude of Mr. H. in this matter, I am enclosing a copy of his letter with a copy of our reply. You will note that Mrs. H. brought their child to our office for an x-ray examination at the suggestion of Dr. Q. of this city. The work was accepted and, as far as I know, no ob-

jection was made until after I had sent Mr. H. several bills to his place of business in B. Then he wrote me a complaining letter in which he protested our habit of not sending him the x-ray films. This was the very first that we heard that he wanted the films or copies of the same.

"It is our custom to keep on file in our office all original negatives, because when we release the negatives we are then without any evidence upon which to base our diagnosis. We are willing at all times to loan the films in each and every case. Mr. H., on his visit to E., did not come to see us in regard to the matter, and made no demand, written or verbal, to our office for the privilege of seeing the films or borrowing them for his physician's inspection.

"Mr. H. certainly owes this bill just the same as if Mrs. H. had taken her son to a store and bought a suit of clothes for him in the absence of his father. Our work was done in good faith and in the best possible manner. We will be very glad indeed to have your representative in B. consult the leading physicians there regarding our professional standing and the reasonableness of our fee of $35.00 for an x-ray gastrointestinal study. Dr. E. S., a roentgenologist of B., will be pleased to tell you, I am sure, if our charges are reasonable and if our practice of keeping a file of the films is unusual.

"We regret very much to be forced to take the only course left open to us in this matter. With all fairness to Mr. H., I would suggest that your representative see him again and try to get him to close this matter by paying the account, but if he refuses to do this we are enclosing our check for court costs and will expect you to proceed according to law, as is our custom in such cases."

So that he might have what he hoped would be a somewhat broader and a more authentic aspect of the situation, this attorney asked Dr. E. S. about the matter, who, after giving his own opinion and approval to all the two high radiological authorities had done and claimed, suggested that he (the attorney) write me relative to the affair. Consequently I received the following: "Dr. E. S., who is a member of the same medical association with you, tells me that you would likely be glad to furnish me with information pertinent to a suit I have against a Mr. H., of B., for Drs. N. and N., of E. These latter run an x-ray laboratory in E. and also are members of the same medical organization.

"Enclosed you will find copies of letters, etc., which will give you data in the case. Wish you would kindly give me information regarding the customs of x-ray specialists as to what is a reasonable charge, to whom their bills are sent usually, the letting out of films and copies of films, wife contracting debt under the present circumstances, and any other data of recent cases, etc., that would be of benefit to me in winning this case for Drs. N. and N.

"As the time is very short before the trial, will ask that you kindly forward me this information, if you will, at your earliest convenience. I did not have time to have Drs. N. and N. write you and then send your answer to me."

I immediately replied: "While I do not pretend to be an authority upon the law in the questions you ask, I will give you my opinion in regard to them and will assure you as regard the question of the ownership of the roentgenograms. Several attorneys who have threatened to bring action to force physicians to deliver the roentgenograms to their clients have either withdrawn their action or have stopped any action after being shown a copy of the enclosed reprint entitled 'The Ownership of the Roentgenogram.'

"Your inquiry as to 'what is a reasonable charge,' is entirely too vague and indefinite for intelligent reply by me. I must know more about what was done by your clients before I can answer. A complete gastrointestinal examination would justify charging a fee of from fifty to two hundred dollars, and this would be reasonable enough if any great amount of service was rendered.

"Bills for services rendered to minors should be rendered to their natural parent

or guardian or to such other legally qualified person if no parent or guardian exists. If the services were rendered to a child, and contracted for by the mother, the father, if alive, would, of course, be liable for the bill, unless he had advertised that he was not responsible for bills contracted by his wife. That would hold good in commercial lines—if the wife bought shoes or pie for the child—and there should be no difference between needful goods and drugs or medical services. Certainly no court or jury would see otherwise. There are dozens of decisions by courts of last resort, applicable to this question. I am enclosing a clipping from a magazine in which a paper of mine is published, which contains several citations which apply here. Am also enclosing reprint of tenth and eleventh installments of a series of papers on "The Law and Medicine" from the same magazine, which contains excerpts from decisions you may find of use.

"I am very much interested in these subjects and would like to have you inform me as to the final outcome of this case, when it is disposed of. Please do this.

"Trusting that my feeble efforts may help my friends in E. in securing justice . . . ."

I did not hear from the attorney, but one of the men involved informed me verbally that the bill was paid.

While the foregoing may at first glance seem to be an unnecessarily elongated tale I believe that it is a decidedly worth while lesson in how to collect our fees.

### "PAYMENT IN FULL" MEANS JUST THAT!

About twenty years ago, the writer rendered services to a family, the head of which was moderately well to do, but who was slightly hard to collect from. A bill in the amount of $85.00 was sent him. After a considerable time, the debtor sent me a check for $50.00, accompanied by a letter stating that "the enclosed check is payment in full for services rendered." I immediately acknowledged receipt of the payment "on account" and sent a receipt, stating that there was a balance of $35.00 still due me The check was endorsed by me, "Payment on account, leaving a balance due of $35.00."

After several months had passed and several unsuccessful attempts had been made to collect the balance, the account was sent to a collection agency. In due time the agency brought suit for the balance due.

At the trial, before a municipal court judge, the defendant's attorney presented a carbon copy of the letter which had accompanied the check and the judge immediately rendered a decision in favor of the defendant in the suit. He (the judge) stated: "The tender of the check as payment in full and the acceptance thereof, no matter how the check was endorsed, could not be separated. The acceptance of the check by the plaintiff involved acceptance of the conditions under which it was tendered. The law permits of no other interpretation of the acceptance of the check as payment in full than that it, along with the stipulation, was accepted. Furthermore, acceptance of the check implied acceptance and assent to the terms under which it was tendered, and the endorsement, as testified to by the plaintiff, cannot in any way affect the legality of his acceptance thereof as payment in full."

*The lesson is obvious.*

### I HOLD THE SACK

Five young men were suing a millionaire shoe manufacturer and a large rubber corporation for damages to their hands, resulting from their use of unprotected fluoroscopes which they had used while examining about a million rubber shoe heels.

I examined the hands of all the plaintiffs, preparatory to appearing as an expert witness for them. However, before the time for the trial, the defendants settled all the cases. The defendants claimed that they paid the plaintiffs' attorney for my services. Unfortunately for me, he entirely forgot to pay me, so I was left "holding the sack" and the rabbit got away.

# CASE REPORTS AND NEW DEVICES

## RADIOGRAPHS MADE ON THE FLUOROSCOPE

*By* RAYMOND G. TAYLOR, M.D., *Los Angeles*

It is frequently difficult to reproduce on the film gastro-intestinal lesions seen on the fluoroscopic screen unless films are made with the patient in position exactly as in screening. In order to simplify this and produce films of what is seen on the screen, we have for a good many years made films of the stomach and duodenum, and, later, an examination of the lower right quadrant, with the fluoroscopic tube. The technical quality of these films has not always been first-class due to nearness of the fluoroscopic tube to the object radiographed, and other well-known technical handicaps. Nevertheless, they have been useful from a diagnostic standpoint.

The disadvantage in using a tube both for fluoroscopy and radiography is that the tube gets rather hot simply from the fluoroscopy, and when one adds the heat from two or three radiographic exposures, one brings the tube temperature up to a dangerous point, with short life of the tube as a result; this limits one also to a broader focus tube than is desirable for fluoroscopy. To obviate some of these disadvantages we had a double tube holder made and placed on the fluoroscope in place of the regular tube drum. As seen in the illustrations, this consists of a wooden and bakelite frame attached to the trochoscope frame, which carries on a rocking arm, or bar, two ordinary air-cooled radiographic tubes, one of which is a fine, the other a coarser, focus. The rocking arm, or bar, is so arranged that by pulling on the lever *G* (Fig. 1), the far tube is rotated to a point in front of the shutter on the fluoroscope. Pushing the lever *G* toward the fluoroscope (Fig. 2) puts the other tube in the line with the fluoroscopic shutter. The arrangement is very simple and easy for any one to build. The only thing requiring any mechanism of any consequence is the double knife switch which is shown at *B* in the illustrations. This is a double male and female type of switch made of spring brass and carries the filament circuit. They have to be, of course, insulated from one another, which is a simple matter.

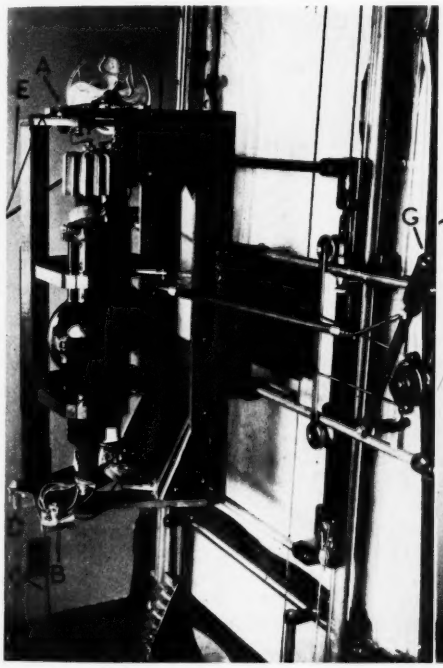


Fig. 1.

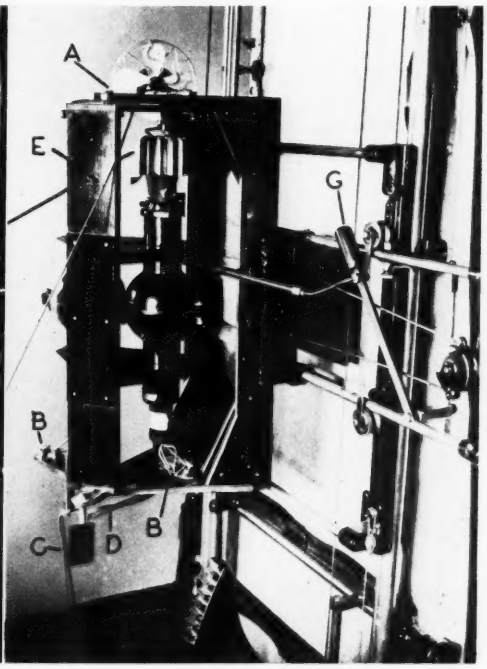


Fig. 2.

*D* is a spring which is attached to the rotating tube bar so that, whichever tube is in active use, the metal fixture to which the spring is attached at the base of the tube bar, rotates off center and tends to hold the tube in position.

*A* represents the bolt on which the tube bar is rotated; *E*, the high tension line on the anode side, and *C*, the high tension line on the cathode side carrying the filament current.

These tubes are enclosed in ordinary black lead glass bowls which afford fairly adequate protection.

A cooling fan is placed on the top of the tube carriage. This plays a current of air on the radiators.

Our tube life before using this apparatus did not average over three months. These two tubes have been in position and taken the entire work of the laboratory, as far as fluoroscopy and radiographs on the fluoroscope are concerned, for over two years, and are still in a very useful condition.

This apparatus can be cheaply built by any good mechanic. In our own set-up we have a remote control switch sitting beside the fluoroscopic table by which change from the radiographic to the fluoroscopic setting and *vice versa* can be obtained by merely turning one switch. This takes care of the filament, voltage, and milliamperage. We are able to vary both somewhat, but find a standard setting gets satisfactory radiographs, for the most part, varying only the time.

Such an arrangement as this, in connection with one of the serial plate changers, which now can be obtained for use in connection with the fluoroscopic screen, makes an ideal arrangement for serial radiographs.

1212 Shatto St.

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## BATTERY-OPERATED GEIGER-MÜLLER COUNTER WITH A NEW TYPE OF VOLTAGE SUPPLY

*By* ROBERT B. TAFT, M.D., B.S., M.A., F.A.C.R.,
*Charleston, South Carolina*

A Geiger-Müller counter operated entirely from batteries is an excellent instrument for anyone who is interested in the study of small quantities of radio-active material, and, as a detector for lost radium, has many advantages over other types of equipment. As the technical data on an instrument of this kind have apparently not been published, this paper seems to be justified.

Figure 1 shows the complete instrument with the cover lifted. The circuit is essentially the same as that in the A.C. set of the author's (1), the Locher tube is the same, and the first amplifyer is a Type 32 radio tube,

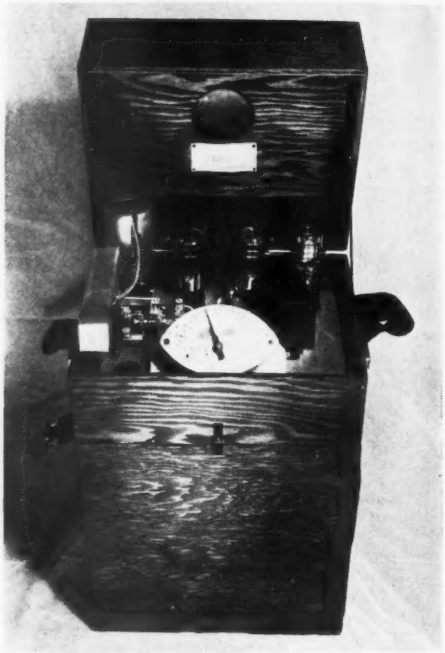

Fig. 1. The battery-operated Geiger-Müller counter, in a case with the cover lifted.

the other three being Type 30. The output from the control tube is fed to a sensitive relay of the kind so common in use with photo-electric cells, and the recording counter is the unit from a demand wattmeter. The filaments are supplied by two of the new standard dry batteries, which are approximately half the size of the old No. 6.

Ninety volts of B batteries are used and after some consideration the standard size radio batteries were adopted; though much larger in size and weight, they are of much longer life, quite inexpensive, and, most important of all, easily obtainable even in small towns.

A small neon lamp serves as an indicator for impulses which are too numerous to be recorded.

The source of high voltage for the Locher tube (about 800 volts) is not simple to obtain. Small batteries can be gotten but their expense and short life present some obstacle. The method of charging a large condenser which holds its charge for some time is, of course, an old idea, but the author has not found it satisfactory for use in a hot humid climate, though it was used with fair success during the winter time.

The author's present voltage supply has been in constant use for about eight months, and, during that time, has given complete

success. It is made entirely of inexpensive parts which are obtainable practically anywhere. It operates on the principle of the vibrators which are so commonly used in automobile radio sets, a model "T" spark coil, with the vibrator spring ground down to about half thickness, being the transformer. The high voltage is rectified by a Type 30 tube, the grid being connected to the negative side of the filament. Though greatly overloaded, this tube seems to stand up continuously. A two microfarad, 2,000-volt condenser smooths out the current and the 10 megohm resistance has a tendency to steady the voltage. After the vibrator is adjusted, the voltage remains within reasonable limits for many hours of operation. Two new standard dry batteries supply the power for both the coil and the filament of the tube through the unusual hook-up illustrated, as the positive high tension pole of the coil is grounded and the entire system raised to a high negative potential. Obviously, the switch must be well insulated or the hand of the operator will receive an unpleasant shock. The entire system must be shielded in a suitable metal container with a properly insulated negative lead through the shield.

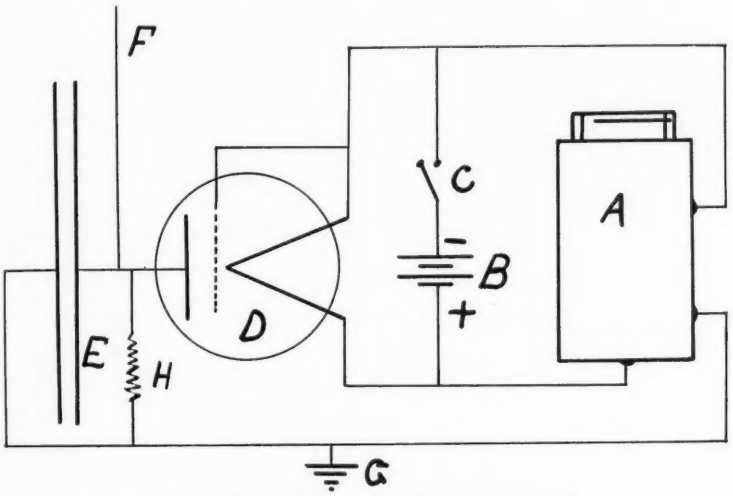


Fig. 2. Wiring diagram of the high voltage supply.
(A) Model "T" ignition coil.
(B) Three volts supply, two dry cells.
(C) Switch.
(D) Type 30 radio tube.
(E) Condenser, 2 microfarads, 2,000 volts.
(F) Line to Locher tube.
(G) Ground to metal shield and chassis of set.
(H) Ten megohms resistance.

105 Rutledge Avenue

REFERENCE

(1) TAFT, ROBERT B.: Technical Data Concerning the Geiger Counter. RADIOLOGY, June, 1936, **26**, 756, 757.

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## A SENSITIVE PORTABLE DETECTOR FOR IONIZING RAYS[1]

*By* J. E. MORGAN, PH.D., *and* ROBERT J. REEVES, M.D., *Durham, N. C.*

From the Department of Roentgenology, Duke University Hospital, Durham, N. C.

Although originally designed for the purpose of tracing and recovering lost radium needles about the hospital, numerous other applications of this portable Geiger counter apparatus have suggested themselves from time to time. For example, it proves itself of particular value in detecting x-ray "leakage," and in making quantitative comparisons of the efficiency of various arrangements of protective shielding. In this connection, it has been found to give immediate and positive indication of radiation intensities which are so small as to require several days' exposure for perceptible blackening of a photographic film. A five-milligram ra-

[1] Accepted for publication July 21, 1936.

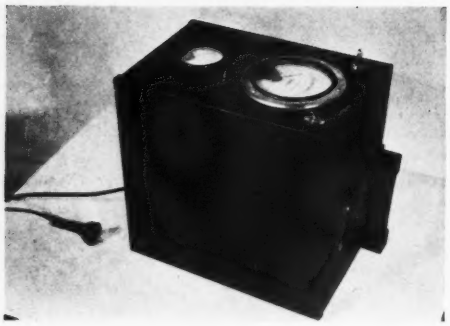

Fig. 1.

be accurately determined. In the first trial, five days after the patient had received an intravenous injection of 75 c.c. of a colloidal suspension of 25 per cent $ThO_2$, the apparatus was placed in contact with the abdominal wall. The indicated ionization at that time was 82 per cent greater than the normal stray radiation which was recorded after removal from the patient. A series of readings taken at successive intervals will furnish valuable information on the rate of excretion of the thorium from the body. A subsequent report will discuss these methods more fully as further clinical data are accumulated.

The entire apparatus is contained in a small

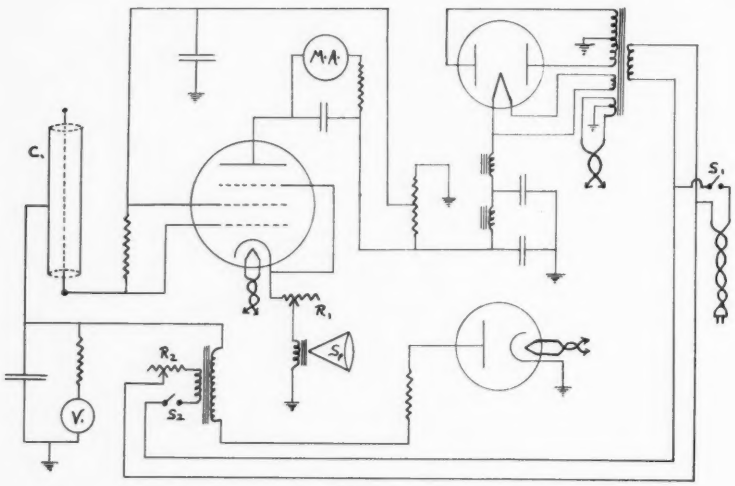


Fig. 2.

dium needle, enclosed in a half-inch of lead, can be detected immediately at any distance up to ten meters. The radiation from approximately 300 mg. of radium has been measured through three inches of lead, a half-inch of steel, and three meters of air.

Actual clinical applications are varied and many problems are yet to be worked out. For many years, the tolerance dosage of x-rays and radium has been roughly estimated by various means, but no method has been accepted as entirely accurate for tissue tolerance. By calibrating the counter apparatus in roentgen units, this can now be accurately recorded by measurement of dosage rate per unit time, and integration of this rate over the total exposure.

The slightly radio-active chemicals, thorium dioxide and hydroxide, which are gradually assuming importance as definite diagnostic aides, can now be detected within the body and their rate of absorption and excretion can

metal case (Fig. 1), and has a total weight of approximately twenty pounds. A convenient carrying handle completes the feature of portability, and permits operation over an area limited only by the length of extension cord available from the nearest 110 volt A.C. outlet. The circuit (Fig. 2) employs a small Geiger-Müller counter, directly coupled to the single high $\mu$ amplifier tube. It will be noted that the counter resistor, which also serves as grid resistor for the amplifier, is returned to the screen grid (+150 volts) instead of to the ground. This arrangement tends to decrease the time required for grid and counter wire to return to normal voltage after receiving the negative swing of a counter discharge, and thereby considerably increases the resolving power for individual counts. A small loud speaker (S) in the cathode return lead makes these counts audible as distinct clicks for qualitative indiction of the presence of ionizing radiations. Lead shielding on three

sides of the counter gives a distinct directional effect which is valuable in locating lost radium, etc.

The unique feature of the circuit, however, is the use of the Geiger counter as an ionization chamber. In the case of intense radiation, such as that encountered near x-ray equipment or appreciable quantities of radium, the ordinary capacity coupled Geiger counter amplifier would become "paralyzed," that is, the bursts of ionization in the counter tube would succeed each other with such rapidity that the counter wire would be unable to recover its normal potential in the short intervening period, and would, therefore, be unable to deliver to the amplifier grid the sharp voltage pulse necessary to cause a "count." This difficulty is overcome by the direct coupling of counter to amplifier, and the use of a plate milliammeter (ma.) as an indicator for high intensities of ionization. In operation, the cathode bias control ($R_2$) is set for full scale reading of the milliammeter with the counter voltage turned off. When the high voltage is applied to the counter by closing the switch ($S_2$), a normal rate of about eight counts per minute from cosmic rays, etc., is observed. Each count manifests itself as a sharp click in the speaker and a slight negative swing of the milliammeter needle. When the counting rate is increased by exposure to ionizing radiation, the clicks and associated dips of the meter occur with greater frequency until at a rate of some hundreds per minute, the audible clicks blur into a faint buzz. Before this point is reached, however, the current pulses have become sufficiently rapid so that the resistance-capacity filter around the meter is able to smooth them out into a relatively steady deflection.

The loss of distinct pulses, which are so essential to a pure "counting" circuit, is then of no disadvantage. As the gas within the counter becomes more and more conducting, a corresponding increase of current through the common counter-and-grid resistor applies an increasingly negative bias to the amplifier tube so that the plate current is reduced by a factor proportional to the intensity of ionization.

For use in research, in which case accurate quantitative measurements of small intensities are necessary, a mechanical watch-type recorder incorporating an extra stage of power amplification, for plug-in connection to the main circuit, is now being constructed. In routine radiological work, however, the original design has proved entirely satisfactory.

Except for the Geiger-Müller counter, standard radio receiver parts may be used throughout. A Type 58, or 6D6, tube may be employed for the amplifier, a 0-1 milliammeter (5-inch size is preferable) for the plate current indicator, a 750-volt, 1,000 ohm-per-volt, meter for the counter potential, and a series-parallel arrangement of 500-volt electrolytic condensers for the high voltage filter. No batteries are necessary. For the high voltage rectifier, a Type 57 tube was employed, connected as a diode, with the control grid used as plate and the screen, plate, and suppressor left floating. In order to make this practical, it is necessary to observe the precaution of allowing the filament to become thoroughly heated before the high voltage is applied. Otherwise, the oxide coating on the cathode will be destroyed and the tube ruined. This high voltage rectification may also be accomplished by the use of one of the commercial rectifying tubes, if the power transformer employed has sufficient capacity to furnish the heavier filament current necessary.

SUMMARY

A simple and effective circuit is described, whereby a small Geiger-Müller counter is made to act as a sensitive detector of ionizing radiation, and also as a direct reading ionization chamber for greater intensities. The entire equipment is inexpensive and easily portable, and may be readily used by an inexperienced operator.

## ROENTGENOLOGICAL FINDINGS IN PICK'S DISEASE

### CASE REPORT

*By* S. A. MORTON, M.D., Roentgenologist, Columbia Hospital, *Milwaukee, Wisconsin*

Adhesive pericarditis may give rise to a variety of manifestations elsewhere in the body. When it is associated with a recurrent ascites and a large liver, the abdominal manifestations have been given the name of Pick's syndrome. Many writers refer to the whole condition as Pick's disease, and for the purpose of convenience, the name will be so used in this present case report.

The various x-ray manifestations of this condition have been described in different articles on the subject of Pick's disease. The case to be reported is interesting because the diagnosis of Pick's disease was first suggested by x-ray examination. It is also of interest because of the extent of the thoracic findings.

The patient was a boy nine years of age, who was well until four years previous to examination. There is no history of arthritis, tonsillitis, chorea, or heart disease.

Four years previously, the mother noticed that the child's abdomen was enlarging and

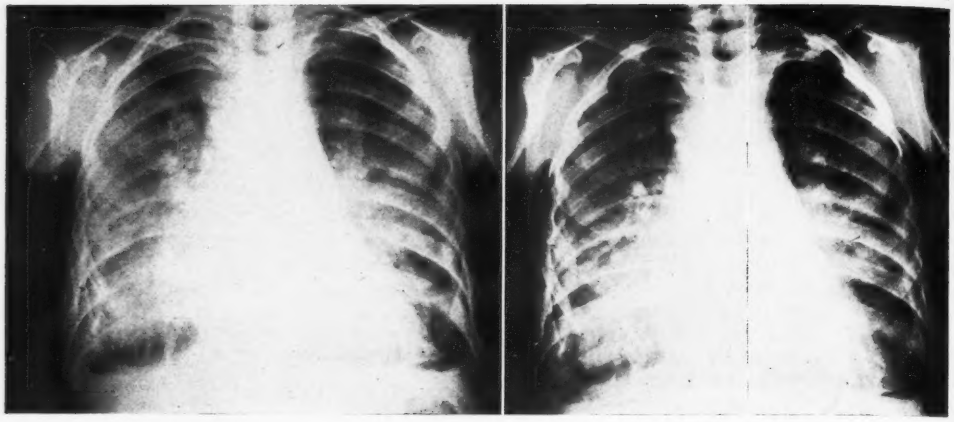

Fig. 1 Fig. 2

Fig. 1. Postero-anterior view of the chest taken with about twice the usual exposure time. Note the pleural thickening, the mediastinal widening, the indefiniteness of the heart border, and the passive congestion.

Fig. 2. Postero-anterior view of the same chest taken with about four times the usual exposure factors.

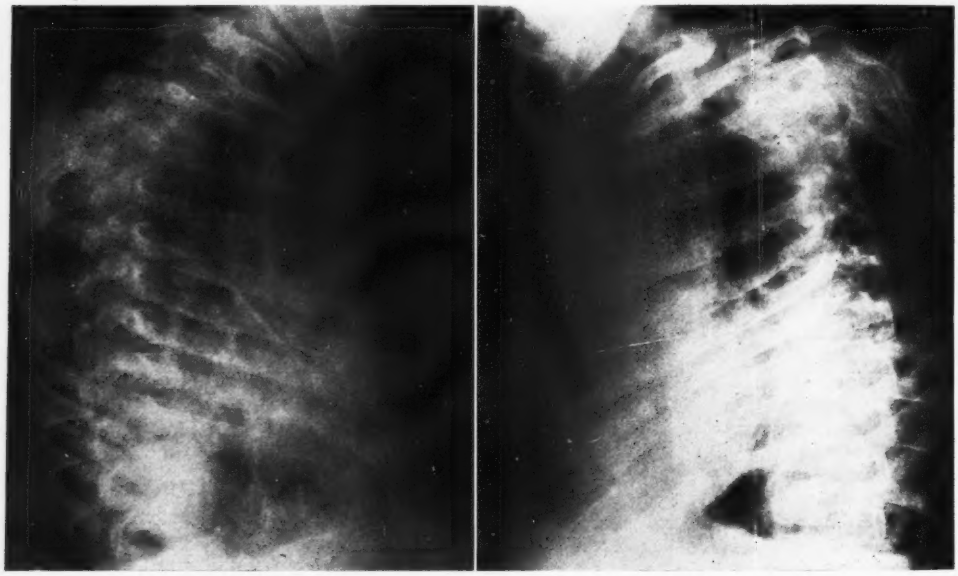

Fig. 3 Fig. 4

Fig. 3. A right oblique view, showing the mediastinal infiltration and the pleural thickening.

Fig. 4. A left oblique view, showing the mediastinal infiltration and the pleural thickening.

that he tired easily. He could not play with the other children on account of shortness of breath. His appetite was good.

He came to the hospital for investigation and a chest x-ray examination was ordered as a matter of routine. The case came to my attention because the technicians could not get a satisfactory plate of the chest even with twice the usual exposure for a child of this size. Satisfactory plates were obtained with from three to four times the usual factors and the patient was examined fluoroscopically.

Fluoroscopy of the chest was very interesting. The descent of the diaphragm on inspiration was distinctly limited, but what there was of it seemed to leave the heart suspended in the

chest with a relatively clear space between it and the upper surface of the diaphragm. Because the heart was small and its pulsations were feeble, it was difficult to define its various chambers. The superior mediastinum was very broad for a child and pulsated violently. In the various oblique positions the mediastinum was much more dense than is usually seen. There was no displacement of the esophagus or delay in swallowing.

Examination of the radiographs showed that the bony structures were normal. The upper part of the mediastinum was unusually broad for a child and seemed continuous with the great vessels. In the oblique views the mediastinum seemed unusually dense, and it was possible to demonstrate adhesions between the heart and the pleura on the anterior aspect of the chest. The heart was small and its borders were hard to define on account of adhesions and pulmonary congestion.

Both costophrenic angles were filled up and there was a very marked thickening of the pleura, extending up on the periphery of both lungs as far as the axilla. There was an infiltration of the basal part of both lungs suggestive of passive congestion.

The x-ray evidence of an association of mediastinal and pericardial inflammatory disease, with an extensive thickening of the pleura together with a swollen abdomen, presumably due to a chronic peritonitis, suggested a diagnosis of chronic adhesive pericarditis with a polyserositis.

Further examination of the child with this in view revealed dilatation of the veins of the neck and upper thorax. The apex beat could not be felt, and there was a pulsus paradoxus present but no Broadbent's sign. The boy also had a hydrocele in the left side. The electrocardiogram revealed a fixed mediastinum.

No significant finding was noted in the examination of his blood or urine.

The physical signs, together with the x-ray evidence and the history, made a relatively sure diagnosis of an indurative mediastinopericarditis with a Pick's syndrome and pleuritic involvement.

The patient died following cardiolysis, and postmortem examination confirmed the presence of Pick's disease.

The x-ray plays a definite rôle in the diagnosis of Pick's disease and should be used in all cases. The fluoroscopic observation is exceedingly important, and particular care should be taken to notice the character of the cardiac pulsations and the manner in which the heart behaves during respiration, as well as the clearness of the mediastinal spaces as observed in the various oblique projections.

An unusual feature of the reported case was the marked thickening of the pleura.

# EDITORIAL

LEON J. MENVILLE, M.D., *Editor* HOWARD P. DOUB, M.D., *Associate Editor*

## PRE-TREATMENT EXPLANATION

Co-operation between therapist and patient is a necessary factor in any treatment, especially so in the radiation treatment of malignancy. Ignorance on the part of the layman in regard to radiation therapy is a frequent impediment to co-operation, and precautions should be taken to guard against it.

It is natural enough that the radiologist should have more of a task on his hands in the way of educating his patient than does the surgeon, as we readily realize when we consider the relative ages of surgery and radiology. Radiation therapy being, so to speak, a youngster, has a more limited acquaintance in the lay world than does surgery. When Mrs. Brown goes to the hospital for a surgical operation, it is probable that her next-door neighbor knows someone "who had the same thing done," and has prepared Mrs. Brown for the worst in the way of post-operative sequelæ. The patient's family and the surgeon also expect that a more or less stormy convalescence will follow major surgery, so that, while these effects may cause apprehension for the patient's welfare, they are in some degree taken for granted, and the operation is performed without interference.

Radiation therapy for malignancy is a severe procedure, and certain sequelæ follow. But, unless the radiologist tells Mrs. Brown and her surgeon what to expect, they are unprepared for the post-treatment condition, and, through ignorance, are apt to be unnecessarily alarmed and even interfere with the completion of the treatment planned. To avoid such results, the radiologist should painstakingly explain the reasons for the entire procedure and its results on the skin and underlying internal organs. He should explain them not only to the patient, but to her family physician—the referring physician. Unless he does so, it is small wonder that the patient and her friends become alarmed at the apparently deleterious end-results of the radium or roentgen-ray treatment and are ready to accuse the radiologist of malpractice.

In short, unpleasant relationships between patient and radiologist, as well as unnecessary disappointment and fear on the part of the patient, may easily be avoided by a little pre-treatment explanation.

JOHN T. MURPHY, M.D.

## ANNOUNCEMENT

### THE ANNUAL MEETING

Netherland Plaza Hotel, Cincinnati
Nov. 30–Dec. 4, 1936

The Counselors' Dinner, an important annual event with many members of the Radiological Society of North America, will take place at 7 P.M., Monday, November 30.

The Carman Lecture will be delivered at 8 P.M., Tuesday, December 1. Dr. James T. Case, of Chicago, will be the speaker.

The Annual Banquet will be at 7 P.M., Thursday, December 3. The features which render this annual affair one of pleasure to those who attend and of significance to the Society, will all be provided.

## COMMUNICATIONS

### THE SECOND INTERNATIONAL CONGRESS OF THE SCIENTIFIC AND SOCIAL CAMPAIGN AGAINST CANCER

*Brussels, Sept. 20–26, 1936*

When the delegates, approximately four hundred in number, from 42 nations, assembled at Brussels on September 20, they were received and welcomed by His Majesty the King.

The sessions opened at the Medical High School on Monday morning at nine, in six simultaneous sections, and in the afternoon the specially invited general reports were heard in three sections. There were six languages in official use—English, French, German, Italian,

Russian, and Spanish. This arrangement proved rather cumbersome, but was clarified somewhat by abstracted translations in each language of such papers as had reached Congress headquarters in time for printing. Unfortunately, only a comparatively few were thus prepared.

It was a busy week, and every science which has a bearing on the cancer problem was ably presented by leading members of the learned professions from all over the world. Biology came in for a goodly share in the program, and from the United States, Dr. Maud Slye gave some convincing statistics which make one think very seriously of the great importance of heredity in cancer incidence. Cellular pathology and tumor pathology played important rôles in the discussion, and our own Dr. Ewing was the usual master in these ceremonies. Other Americans I had the pleasure of contacting were our good friends Francis Carter Wood, William S. Newcomet, and, from the West, Dr. Payne Palmer, of Arizona, representing the American College of Surgeons. My clinical associates and myself presented a paper entitled "Our Concept of the Management of Cancer Patients by Modern Therapeutic Methods." In the Section on Radiation Therapy, Hermann Wintz, of Erlangen, presented statistics on five-year clinical cures which were highly illuminating and most satisfactory. His article and report evoked a spirited discussion, as his results in cancer of the breast were well above comparable surgical statistics. Later, in talking with Professor Handley, Great Britian's well-known surgeon, we found him in harmony with post-operative radiation but not with pre-operative. This brings up the question, Why are the majority of surgeons opposed to pre-operative radiation? Surely there is enough clinical evidence now established that the cancer cell is more readily killed by irradiation before surgery, trauma, or irritation than later. (See Editorial in RADIOLOGY, of March, 1936, page 371.) One of the outstanding reports of the meeting was given by Dr. Dublin, of New York City, concerning cancer statistics and cancer mortality in the United States. It evoked much interest, as did also his resolution that cancer be made a reportable disease—the latter received much favorable comment from the delegates. There was, of course, a tremendous volume of material brought before the Congress which cannot be commented on in this brief report, but which will be made available later in printed form.

The social program was also interesting. The reception tendered the congressionalists and their ladies by the Prime Minister and members of the Royal Cabinet called forth a full representation. There was also a well attended theater party on a following evening. The closing subscription banquet also brought a full house. It was a colorful ceremonial, with the presentation of distinguished foreign delegates. When Dr. A. Béclère, our beloved dean of radiologists, was introduced by the toastmaster he was accorded an ovation the like of which I have never witnessed before. He surely is "the Grand Old Man of our martyred science."

In conclusion, your scribe was happy to learn from a great many of our foreign friends that they were planning to attend our Fifth International Congress of Radiology in Chicago next September.

ALBERT SOILAND, M.D., Commander (M.C.),
U. S. N. R.
Delegate, Medical Dept., U. S. Navy, to
Brussels Congress

## INSTRUCTION IN ROENTGENOLOGY

Apropos of the subject of post-graduate teaching in radiology, the importance of the association of anatomical and pathological data in relation to roentgenology is a fact with which no one can afford to disagree, and there is no doubt that further improvement in roentgen interpretation will have to be developed along these lines.

The main differences in opinion seem to be in the method of teaching employed, especially with respect to the place and amount of laboratory work in the curriculum. It appears that the average pathologist, physiologist, or anatomist is not prepared to establish the proper correlation between these branches and radiology. This can be further supplemented with the statement that neither is the student prepared for such correlation without a preliminary course of instruction in the basic principles of roentgen interpretation.

The foregoing also applies to residents, rotating interneships, or externes, and even to a considerable number of radiologists, who apply for so-called "refresher" or advanced courses of instruction. All of these appear deficient with regard to the basic principles of interpretation as well as lacking a systematic scheme of analysis from the radiologic aspect.

There is the need for comprehension of aver-

age normal, borderline variations, and development, as well, of basic information with regard to pathologic change as radiologically visualized. There is unfortunately too much clever guessing and comparison with films of so-called roentgen "characteristics."

For the radiologic specialist, the closest of linking with pathologic data is essential. However, the instruction of anatomical, pathologic laboratory work before the basic knowledge of roentgen physics, technic of projection, and the fundamentals of interpretation have been acquired is a mistaken method of procedure. All of this presumes satisfactory medical training, interneship, and general clinical experience. The radiologist is studying pathology in the living, which is often quite different from that in the dead body, the inert organ, and the shriveled specimen of the pathologist.

In addition to the foregoing, I will requote a few radiological maxims which convey my idea of the basic principles upon which instruction in roentgen interpretation should be founded, as follows:

*Maxim I.*—Roentgen interpretation based on physiologic-anatomic facts is practically a science

*Maxim II.*—Proper application of physico-technical factors based on dynamic, gravitational, and hydrostatic principles approaches 100 per cent accuracy.

*Maxim III.*—It is important to remember that color, consistency, cell types, and organisms are not radiologically determinable.

*Maxim IV.*—Granting the importance and value of clinical data in the final diagnosis, pure roentgen interpretation is entirely dependent upon gross pathological change with the following information available: (*a*) Origin, area involved and special predilection; (*b*) Types of infiltration (gross pathological data); (*c*) Method of spread (invasion and activity); (*d*) Physico-anatomic and physiological alterations; (*e*) Reaction and progress.

Whether the program of instruction be intended for the recent graduate leaning towards radiology as a specialty, or whether it be for the radiologist seeking further knowledge, a thorough comprehension of the material as above outlined is essential before laboratory and research work is undertaken. Whether this be diagnostic radiology or therapy is immaterial.

In the foregoing, there can at best be but a difference of opinion with regard to the method of approach. The motive and desire to advance the science and art of radiology remain the same.

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## POST-GRADUATE COURSE TUMOR CLINIC

The Journal makes an earnest endeavor to present to its readers information of such educational opportunities as come to its notice. The Editor will appreciate receiving advance information, so that the Journal's readers may attend clinics, conferences, and the like.

The above-named Tumor Clinic was held in Chicago, Sept. 21–27, 1936, sessions being held at the Palmer House, Michael Reese Hospital, and Hines Veterans' Hospital in the suburb of Hines, Illinois. The course was arranged in the form of clinics, lectures, demonstrations, and round table conferences. There was a Breast Tumor Symposium, on which the speakers were Sir George Lenthal Cheatle, Dr. Henri Coutard, and Dr. Max Cutler; a Symposium on Intra-oral Cancer, the speakers being Dr. Coutard and Dr. Cutler; a Symposium on Pelvic Tumors, with the same speakers, and a Symposium on High Voltage X-rays, the speakers being Dr. Arthur Compton, Dr. G. Failla, and Dr. Henri Coutard.

Great benefit was derived from the Clinic by those who attended it.

## MEETING OF ILLINOIS RADIOLOGISTS

The Illinois Radiological Society and the Chicago Roentgen Ray Society held a joint meeting at Starved Rock State Park, Illinois, on Sunday, October 11. In addition to the discussion of several interesting cases the following program was presented:

The Diagnosis of Chronic Cholecystitis. Dr. W. H. Cole, Prof. of Surgery, University of Illinois.

The Illinois Occupational Disease Law. Oliver E. Mount, Chairman of Committee on Occupational Disease, Illinois Manufacturers' Association.

## CAMP TRANSPARENT WOMAN

The Camp Transparent Woman was unveiled in New York City in August in the private preview room of the New York Museum of Science

and Industry, in Rockefeller Center, by Dr. Dean Lewis, of Baltimore, before a distinguished gathering of noted scientists, leading contribution to public health education in America.

The figure is constructed entirely of a trans-

Fig. 1. Left to right: Dr. Dean Lewis, who unveiled the Camp Transparent Woman; Dr. Roy Chapman Andrews, Director, American Museum of Natural History, New York City; Mr. S. H. Camp, of Jackson, Mich., who brought the Transparent Woman to the United States as his contribution to public health education.

medical authorities, and prominent public health officials. Dr. Roy Chapman Andrews, Director of the American Museum of Natural History, was also a speaker on this program which was nationally broadcast. The exhibit was brought to America, and is loaned by S. H. Camp, manufacturer, of Jackson, Mich., as his parent material making every organ, even the veins and circulatory system, as clearly visible to the observer as though he were possessed of x-ray eyes. It will be taken on a nationwide public health educational tour of a hundred cities which is expected to last more than two years. It will be accompanied by a doctor-

Fig. 2. The Camp Transparent Woman, the first and only one in the world, which will shortly leave the New York Museum of Science and Industry for a nationwide public health educational tour of a hundred cities which is expected to last more than two years. It will be accompanied by a doctor-lecturer who will introduce the exhibit to the profession, scientists, and public health officers nationally, and to the general public in a series of lectures to which admission will be free. At the close of the tour it will be given to some prominent medical school or museum for permanent exhibition.

lecturer who will introduce the exhibit to scientists, the profession, and public health officials nationally, and to the general public in a series of lectures to which admission will be free. Mr. Camp has said that he proposes to donate the transparent figure to some medical school or museum for permanent exhibition at the close of its educational tour, during which he expects it to be viewed by several million women.

Cellhorn is the substance of which the figure is built. It is important that an exhibit of this kind, to be successful, must be impervious to the normal dangers of changing temperature and travel. Previous attempts, made with a "wax" figure, were unsuccessful because temperature changes caused the figure to lose its perfect proportions.

The Camp Transparent Woman, however, was not brought to America to teach the details of anatomy. Rather, it is a unique and dramatic public health educational exhibit through which the intricate structure and perfectly functioning mechanism of the female body may be seen as a whole for the first time in human knowledge. It is the result of twenty years of laboratory research and was achieved through the combined efforts of the wood carvers, electricians, laboratory workers, artists, sculptors, medical authorities, and scientists of the Hygiene Museum in Dresden. Actually nearly two years were spent in the construction of the present figure. It is exhibited in a heroic pose, arms outstretched above the head. Ethnologically, it might be described as a universal Caucasian type of approximately thirty years of age.

The figure stands on a gleaming round silver mounting in the center of the opaque glass-covered interior of an octagonal walnut wood base. Inside the glass interior are 121 lamps which light up the figure indirectly after each demonstration. Inside the figure itself are 20 sets of two lamps each which light up each organ in sequence while the exhibit is being demonstrated. These lamps were specially constructed for the exhibit and are only four volts each. Thus while the figure is amply lighted for demonstration it will not become overheated. The lamps in the interior of the figure are shaped according to the contour of each organ. As each organ is illuminated, its name is automatically flashed on a glass label on the side of the base. These are in duplicate for the convenience of onlookers.

During its demonstration the brain, from which the skull cap is removed, is first illuminated; then the larynx, thyroid gland, lungs, heart, etc., follow in turn. At the close, the whole figure stands forth in natural colors, fully illuminated from the base. The exhibit, which is ingenious in more ways than one, may also be demonstrated manually so that the

doctor demonstrating it may light up any organ, or any number of organs at the same time. The figure operates on its own motor.

In constructing the Camp Transparent Woman, a series of photographs were first made of normal organs. The negatives of these photographs were then projected on a screen, and from their giant enlargement a series of drawings were made by the artists co-operating in the figure's construction. These drawings are the basis of the sculptors' work in making the moulds for the various parts. During this phase of the exhibit's construction the most detailed supervision was maintained by the medical authorities in the museum, so that each organ and artery is scientifically accurate in color, size, and dimension. After the various sections had been fabricated from cellhorn, a model of the entire figure was made.

Here again all delineations and measurements of the figure received the most careful supervision of the competent authorities. This model is actually a life-size figure in plaster of Paris, based on the scientific measurements of the skeleton, bones, and major organs. From this model the complete cellhorn skin silhouette was moulded. This was cut in half for delicately adjusting the internal sections in their proper places and in accurate relationship to the whole. The upper and lower sections were then joined together, making the Camp Transparent Woman complete in every detail. It is the first Transparent Woman ever made, an artistic, technical, and scientific masterpiece. Even the tiny bones of the ear and the little sesamoids in the thumb and large toe are carefully and scientifically arranged in their proper places.

The Camp Transparent Woman will recall the Transparent Man to the scientific world of America. The first Transparent Man was brought from the same source to the Mayo Clinic, Rochester, Minn., where it is now on permanent exhibition. It aroused the widespread interest of the medical and scientific worlds when temporarily displayed in the Hall of Science at the Century of Progress Exposition, Chicago. The educational authorities of that city arranged for 300,000 school children to see the Transparent Man during the last month of its exhibition there.

Only three other Transparent Men have been constructed. One is in the Hall of Man at the Buffalo Museum of Science. Another was secured for the Swedish Red Cross Museum in Stockholm. The third is in the Hygiene Museum in Dresden. The Camp Transparent Woman, however, is the only one in existence.

To scientists and the medical world, the Camp Transparent Woman represents a triumph in the history of anatomical study throughout the world; an important milestone in the centuries of world wide research and experimentation which have culminated in our present knowledge of the human body and its functioning.

## IN MEMORIAM

We have the sad duty to chronicle the passing, on Aug. 5, 1936, of James A. Hampton Webb, M.D., at his home in Wichita, Kansas. He was an admired and respected member of the Radiological Society of North America, of his county and State societies, and of the American Medical Association. He was a

The late J. A. H. Webb, M.D.

diplomat of the American Board of Radiology, as well.

Dr. Webb began the practice of roentgenology at Stafford, Kansas. Following service as a major in the medical corps in France during the World War, he removed to Wichita, where he remained to the time of his death. He was a member of the staff of Wesley Hospital, and was chief of the department of radiology at the County Hospital.

Dr. Webb was highly respected in his local community and by all who knew him.

# BOOK REVIEWS

ROENTGEN INTERPRETATION. By GEORGE W. HOLMES, M.D., Roentgenologist to the Massachusetts General Hospital, and Clinical Professor of Roentgenology, Harvard Medical School, and HOWARD E. RUGGLES, M.D., Roentgenologist to the University of California Hospital and Clinical Professor of Roentgenology, University of California Medical School. Fifth Edition, thoroughly revised; 356 pages, illustrated with 243 engravings. Published by Lea & Febiger, Philadelphia, 1936. Price, $5.00 net.

The Fifth Edition of this popular manual fully sustains the reputation it has achieved as a ready reference for those of lesser opportunity and experience in the interpretation of roentgenographic findings observed in the daily routine. The knowledge gained in a wide experience is succinctly presented, commencing with a comprehensive chapter dealing with those pitfalls of roentgen diagnosis, confusing shadows and artefacts, and offering terse suggestions for their differentiation. In a chapter on fractures and dislocations the authors offer many practical suggestions for the better definition of various types which at times offer considerable difficulty in delineation.

The chapter on bone pathology has been completely revised, particularly in the realignment of the classification of bone changes associated with deficiency diseases, glandular dysfunction and those of somewhat more obscure origin, marble bones, melorheostosis, osteopoikilosis, and Gaucher's disease.

In the discussion of the lesions involving the skull and its contents brief reference is made to encephalography and the recognition of suppuration of the petrous pyramids (petrositis), but the bibliography following this chapter affords reference to the outstanding literature on these subjects. The subject of spinal cord tumors and backward projection of the intervertebral disc is similarly well covered in the chapter on the spine.

The discussion of the heart and great vessels condenses this subject to embrace the majority of practical methods of determining lesions by roentgenographic or roentgenoscopic examination, including the differentiation of aneurysm from inflammatory or neoplastic mediastinal involvement.

In the chapter on the gastro-intestinal tract the roentgen findings in steatorrhea, sprue, and regional ileitis are described. Papilloma and adenoma of the gall bladder are included in the discussion of gall-bladder pathology. Retrograde and intravenous pyelography and the interpretation of the images produced in these procedures are well covered in the discussion of lesions involving the genito-urinary tract, and hysterosalpingography (uterotubography) is discussed and illustrated.

Illustrated with 243 engravings, largely made up of excellent reproductions of roentgenograms, this volume is a worthy addition to the roentgenologic literature.

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RECENT ADVANCES IN RADIOLOGY. By PETER KERLEY, M.D., B.Ch. (N.U.I.), D.M.R.E. (Camb.), Assistant Radiologist, Westminster Hospital; Radiologist, Royal Hospital for Diseases of the Chest; Hon. Medical Editor, "British Journal of Radiology." Second Edition; 322 pages, 176 illustrations. Published by P. Blakiston's Son & Co., Inc., Philadelphia, 1936. Price, $5.00.

This is a manual presenting the x-ray as a diagnostic method and written in such a way as to simplify the interpretation of radiographs for those of lesser experience and assist in heightening the appreciation of the value of the x-ray among general practitioners.

The subject matter is succinctly and comprehensively presented.

In the discussion of fractures, the simulants, accessory ossicles, sesamoids, patella bipartite, Pelligrini-Stieda's disease, and Schmorl's node in the vertebral body, are interestingly interspersed with practical suggestions for the best visualization of various types of lesion; "march foot," or Deutscländer's disease, is differentiated.

In inflammatory diseases of bone, many useful differential points are presented. Under deficiency diseases of bone, pithy, practical descriptions of the various entities are given, and the endocrine disturbances of bone are tersely reviewed. Dystrophies of the skeleton and bone diseases of dubious origin are discussed and classified.

Tumors of bone are presented in a simple and practical classification and differential features are outlined. The chapter on injuries and diseases of joints covers the acute and chronic arthritides, neuropathic arthropathies, hemophilic joints, gout, and groups the various manifestations of osteochondritis in a single category.

The lesions involving the cranium and its

contents, including deformities, are briefly described, and the direct and indirect signs of brain tumor are discussed, including a short but lucid epitome on ventriculography and encephalography. Myelography is also summarized.

In the chapters on the thorax and kymography, the value of the x-ray in the diagnosis of diseases of the heart and the roentgenologic image of the normal heart are discussed in a luminous manner, also the diseases of the aorta and lesions involving the mediastinum. Remarks on bronchiectasis include a description of the various technics used in lipiodol injection. Many practical suggestions are offered for the differentiation of diseases of the lung parenchyma and the better definition of tumors of the lung. Similarly, useful procedures for the delineation and differentiation of pleural effusions are presented, also those for the recognition of eventration of the diaphragm and diaphragmatic hernia.

The chapters on diseases of the alimentary tract contain many practical suggestions and exhibit a wide survey of the literature covering this subject. Cholecystography, retrograde and excretory urography, and hysterography are presented clearly and concisely.

A generous bibliography and a large series of excellent illustrations make this a useful reference manual well adapted to the purpose for which it was written.

DIE HERZKRANKHEITEN IM RÖNTGENBILD UND ELEKTROKARDIOGRAMM. By DR. MED. PAUL UHLENBRUCK, A. I. Prof. an der Universitat Koln, Rhein; Chefarzt der Med. Abt. des St. Elisabeth-Krankenhauses und Deutschen Caritas - Institutes fur Gesundheitsfursorge in Koln - Hohenlind. A volume of 318 pages with 316 illustrations. Published by Johann Ambrosius Barth, Leipzig, 1936. Price, 36 R. M.

Printed beautifully and with abundant, well reproduced illustrations, this volume attempts a correlation between the clinical, roentgenographic, and electrocardiographic findings in a wide variety of cardiac conditions. The technic of cardiac roentgenology and electrocardiography is dealt with adequately. The various diseases of the heart and aorta are then considered by means of well selected illustrative cases. The place of roentgenology and electrocardiography in diagnosis is well described and their relation to each other is established. Roentgenkymography of the heart is briefly described and in some cases its practical use is illustrated.

On the whole, the correlation attempted is adequately accomplished. The volume is essentially one for clinicians and cardiologists. For the roentgenologist there may be too much material devoted to electrocardiography and too little to roentgenology.

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## THE KIDNEYS

Renal Adenoma. James Carver. British Jour. Urol., September, 1935, **7,** 229–234.

This is a report of a case of an adenoma of the kidney in which both pain and hematuria were present, together with a palpable tumor. A list of published cases with similar lesions is included in the article. Albarran attributes the origin of tumors of this type to islands of displaced and imperfectly developed kidney tubules, with their erroneous fusion. On the other hand, Borst contends that they arise from part of the *Nierenanlage.*

D. H. PARDOLL, M.D.

## LEUKEMIA

Practical Application of General Body Exposure with Roentgen Rays in Polycythemia and Chronic Leukemia. Max Sgalitzer. Strahlentherapie, 1936, **56,** 341–350.

According to the author general body exposure in polycythemia is superior to local treatment of many small areas. The patients remain free from symptoms for a longer period when using general body exposures. Another advantage is the absence of skin reactions. Technic: 170 kv., 0.5 mm. Zn + 1 mm. Al, 150 cm. F.S.D., 25 r per sitting over the anterior and posterior body surface. This may be given over a period of six days. Careful blood studies are essential. The same treatment method is recommended in leukemia except that exposures are given every other day and only for four sittings. In children the author considers the method dangerous and contra-indicated.

ERNST A. POHLE, M.D., Ph.D.

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The Treatment and Prognosis of Leukemia, Particularly the Good Results Obtained in Lymphatic Leukemia Involving the Spleen Only. Iser Solomon. Strahlentherapie, 1936, **56,** 526–532.

Following a brief discussion of the present status of radiation therapy in the treatment of leukemia, the author describes two cases of lymphatic leukemia which involved the spleen only. Following radiation therapy one patient is alive now, 19 years after the first treatment; the other patient has been free from symptoms for the last two years. Solomon believes that this special type of leukemia with involvement of the spleen only responds more favorably to irradiation.

ERNST A. POHLE, M.D., Ph.D.

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Lymphatic Leukemic Changes in the Face. E. von Felsenbrunn. Strahlentherapie, 1936, **56,** 69.

The author observed a case of lymphatic leukemia with most extensive bilateral swelling and edema in the face, which developed in a manner very similar to advanced Mikulicz's disease. The patient was not relieved by local x-ray therapy and developed several ulcers on both cheeks and in the chin region. Although high doses had been given, the ulcerated infiltrations were subjected again to fractional therapy under heavy filter (1.0 mm. Cu) up to 200 per cent of the erythema dose. The spleen was exposed at the same time. Under this therapy the swellings and edema decreased somewhat in size. (Note of abstractor: A study of the photographs accompanying this article is recommended.)

ERNST A. POHLE, M.D., Ph.D.

## THE LIVER

Chemical Changes of Proteins *in vivo* during and after Roentgen Irradiation of Liver Tissue. J. Heeren. Strahlentherapie, 1936, **56,** 88.

The author exposed ground liver tissue to roentgen rays. The liver was placed in Ringer's solution and exposed to 180 kv., 5 ma., no filter, 30 cm. distance through a layer of water 3 cm. deep: 550 r were given in 1.9 minutes at 23 cm. F.S.D. Most tissues were irradiated for one and one-half, some for three hours. After irradiation the N.P.N. was definitely increased. There was no increase in the amino-acids but rather a slight decrease. The effect on the autolysis of the ground liver tissue was not uniform.

ERNST A. POHLE, M.D., Ph.D.

## THE LUNGS

Congenital Cysts of the Lungs. Eugene Freedman. Am. Jour. Roentgenol. and Rad. Ther., January, 1936, **35,** 44–52.

Congenital air cysts of the lungs are more common than was previously thought. The roentgenologic appearance is variable, depending on the number and the size of the cysts.

Giant air cysts commonly produce a pneumothorax-like appearance, and if a patient presents the clinical and roentgenologic symptoms of spontaneous pneumothorax without a history of acute onset, the possibility of a giant cyst should be considered. In rare instances a giant air cyst may produce the clinical and roentgenologic symptomatology of an obstructive emphysema.

Smaller cysts, if numerous, produce honeycombed shadows which, at times, mainly if they are situated in the upper lobes, simulate an ulcerative tuberculosis and at other times an extensive bronchiectasis. However, in cases of cysts, there is no evidence of inflammatory changes around the honeycombed shadows, nor of retractive changes in the lung-fields, hila, or thoracic cage, as in inflammatory conditions. Minute, disseminated air cysts may simulate the roentgen appearance of a disseminated tuberculous process or of a fungus infection. At times, smaller congenital air cysts cannot be detected in the roentgenogram, due to thinness of their walls, or because they are obscured by overlying organs.

The extent of the roentgenologic changes as compared with the paucity of the clinical symptomatology indicates congenital anomaly. Most of the cysts contain air, but there is likely to be a small amount of mucus or cellular material in the cavities. At times they may contain large amounts of fluid and become in-

fected. Hemoptysis may occur in congenital cystic lung disease.

The treatment of congenital cysts should be conservative as long as the patient is symptomless. No giant air cyst should be tapped unless it interferes with respiration, because tapping of a giant air cyst may be followed by shock and death. The literature is reviewed and cases are reported.

S. M. ATKINS, M.D.

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Interlobar Pleural Effusions. Barnet P. Stivelman. Am. Jour. Roentgenol. and Rad. Ther., October, 1935, **34,** 475–481.

Interlobar pleural effusion shadows are often misinterpreted. At times they are considered to represent mild and atypical chronic pneumonic processes or are confounded with intrathoracic newgrowth.

Occasionally transudate secondary to circulatory failure may accumulate in interlobar fissures and closely simulate pulmonary consolidation or newgrowth.

Symptoms arising from this interlobar exudate are usually less severe than the lobar consolidation. Physical findings are usually very meager. The leukocytosis is usually less marked in the interlobar effusion than in the pneumonia but the resolution of the interlobar lesion is slower. Lateral roentgenograms are usually the most important in recognizing the interlobar fluid accumulation. The commonest location is between the upper and middle lobes of the right lung, but they may occur anywhere, even including the azygos fissure.

J. E. HABBE, M.D.

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Atypical Pneumonia. Frank Kellner. München. med. Wchnschr., Jan. 17, 1936, **83,** 90–92.

Knowledge of this subject is practically entirely dependent upon roentgenologic examination. Many descriptive terms have been employed heretofore; *viz.*, central, abortive, ambulant pneumonia. Since the so-called "grippe" epidemics have been thoroughly studied the conclusion has been reached that this is merely a catarrhal infection of the upper respiratory tract and bronchial tree, which in most cases evolves into true pneumonitis of various forms and extent. This fact has not been generally recognized by the profession. The author likewise intimates that probably the great proportion of so-termed primary or early infiltrations ascribed to a tuberculous infection is in reality atypical pneumonitis of non-specific origin. Serial roentgenographic study will very often clarify this point.

In children it is the rule to find pneumonitis incompletely involving a lobe, particularly in the base of the upper lobe, as a triangular density with apex directed toward the hilum. Further extension occurs medially and toward the apex. In pertussis there is marked pulmonic involvement in the acute stage, which rapidly disappears in the decrement. The appearance of honeycomb-like densities along the paravertebral borders, extending along the hila to the diaphragms, is typical. Measles presents various pulmonic appearances, predominantly miliary and confluent bronchopneumonia. In infants it is most difficult to distinguish various forms of pneumonia, and it is not uncommon for parenchymal infiltration to be visible for weeks. Thickening of the interlobar pleuræ frequently is discernible as an aftermath of atypical pneumonitis; rarely are fibrotic strands present in the parenchyma. Important from a practical standpoint is the more careful management in cases presenting atypical pneumonia, as compared to the common therapeusis in what is diagnosed as "grippe."

WILLIAM R. STECHER, M.D.

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Congenital Cystic Lung: A Report of Multiple Cysts within an Accessory Lobe. Moreton J. Thorpe. Am. Jour. Roentgenol. and Rad. Ther., December, 1935, **34,** 724–729.

Cystic lung is a congenital developmental anomaly the exact cause of which is not known. The cysts may be solitary or multiple. If enough of the lung or lungs is involved, especially in the presence of infection, it is usually fatal within the first few months of life.

Recurrent attacks of dyspnea and cyanosis, with hyperresonance and displacement of the mediastinum, should suggest a cyst rapidly filling with air. Small multiple cysts, unless infected, may remain silent; when infected, they may simulate bronchiectasis with cough and sepsis.

The cysts roentgenologically are seen to have thin walls, although when infected the walls may be thicker from infiltration and accompanying adjacent atelectasis.

S. M. ATKINS, M.D.

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Roentgen Therapy of Primary Carcinoma of the Lung. L. Popovic. Strahlentherapie, 1936, **56,** 141.

The author reports four cases of carcinoma of the bronchus which were treated by roentgen rays. One patient remained well for 30 months, one died after eight months, one after one year, and the fourth patient —discharged because of the hopelessness of the condition—died two months after treatment. Bronchographic studies are shown in the paper, demonstrating either the stenosis of the affected bronchus or defects in the outline of the tree.

*Technic.*—A modification of Coutard's method was used. A total of 4,000 r were given over a period of from 20 to 40 days with daily doses of from 70 to 100 r; one anterior and one posterior field; 180 kv., 2 ma., 50–80 cm. F.S.D.; 1 mm. Cu + 1 mm. Al; duration of exposure, 45–80 minutes. No permanent damage of the skin was observed in any one of these cases.

ERNST A. POHLE, M.D., Ph.D.

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Congenital Cysts of the Lung. René Pierret and André Breton. Bruxelles-méd., May 31, 1936, **16,** 1172–1189.

Congenital cysts of the lung are of three types: solitary large cysts which may be confused with partial or total pneumothorax; multiple medium sized cysts, to be differentiated from emphysematous bullæ, lung abscess, and purulent pleurisy, and small generalized

cysts which may simulate bronchiectasis. All are congenital malformations and present simply different degrees of a pathologic process starting as a congenital dilatation of a bronchus.

Anatomically two groups may be recognized. The first of these is the large solitary cyst (balloon cyst), which occurs in about 7 per cent of cases, is as large as a goose egg or a lemon, sometimes including a whole lobe or lung. Usually there are no adhesions. It may occur in any lobe and on either side; most commonly, however, it occurs in the upper thorax and there is either compression of the trachea or displacement to the opposite side, displacement of the mediastinum and atelectasis, or compression of limited portions of the lung. When in the lower part of the lung, the costophrenic angle is obliterated, the diaphragm is flattened, and pericardial adhesions may be present.

At autopsy it is found to contain air and some mucus. The cyst may be subdivided into sections which may or may not communicate. The wall of the cyst suggests the appearance of a ventricle of the heart. Usually a communication with a bronchus may be established, though in some cases it is difficult to find.

In the second group, that of multiple small cysts (cystic disease of the lung), there is a honeycomb appearance. In a localized area of varying size, most frequently in the base, there are seen many communicating compartments placed side by side and suggesting a sponge with large cavities. At times these cysts are immediately under the visceral pleura, a possible cause of spontaneous pneumothorax.

While cystic disease is difficult to diagnose clinically, roentgenographically rather characteristic changes are noted and these are usually of three varieties. In one, the large solitary cyst in the absence of infection, appears as a large clear space, occupying part or all of a hemithorax with flattened diaphragm, obliterated costophrenic angle, and the trachea and mediastinum displaced to the opposite side. This clear zone may not be limited by the diaphragm. The lower portion may be somewhat irregular, but the upper border is sharp and definite. Throughout may be seen faint transverse linear markings. Confusion may arise in differentiating such a cyst from either a partial or total pneumothorax.

In the presence of infection the appearance is practically that of a lung abscess. The appearance of a hydro-pneumothorax of variable dimensions, but with regular contours and particularly showing no change in serial films speaks definitely for a cyst.

The second variety, that of multiple cysts of smaller size, is likewise somewhat characteristic. These smaller cysts vary in size from that of a pea to that of an apple and are generally grouped in one lobe. Here again two different aspects may be noted. In one, the annular shadows are regular, their outlines are very fine, but clear, and the shadow of one superimposed on that of another because of their different planes. No fluid level or surrounding parenchymal infiltration is noted. In the other, the annular shadows are less distinct and may be altered by bands of infiltration which run through the parenchyma of the lung and darken it. This condition is most readily confused with lung abscess, but usually the absence of infiltration, the regularity, the clarity, and the fineness of the annular shadows all indicate cysts. They may also be confused with large emphysematous bullæ. They may at times be visualized by instilling radiopaque material, but frequently direct communication with a bronchus is not well established and in such cases the bronchial arborization appears quite limited.

The third type is that of congenital dilatation of the bronchus and here considerable difficulty may be experienced in differentiating between acquired and congenital dilatation. As a rule, congenital dilatations are visible without radiopaque material, while the acquired cannot be seen without it.

The authors believe that thoracentesis is well worth trying as a means of treatment and that, with the development of thoracic surgery, drainage of infected cysts will play a more important part.

JOSEPH DAUKSYS, M.D.

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Pulmonary Asbestosis. Walter Alwens. München. med. Wchnschr., Nov. 8, 1935, **82,** 1797–1800.

The author presents 35 additional cases and an excellent review of the Continental literature on this subject. Inasmuch as pulmonary asbestosis is compensable, all workers in the industries involved should be examined before employment and periodically thereafter. Radiography is necessarily employed, for no characteristic clinical symptoms are found, and rarely are asbestos bodies found in the sputum. In this series, no associated active pulmonary tuberculosis was detected. Roentgenologic findings are always manifest in workers in this industry of ten years' duration, when exposed to the dust hazard. Clinical symptoms of dyspnea, cyanosis, expectoration without hemoptysis were slight, but noted generally in the five- to ten-year interval, and rarely as early as six months. An interesting revelation was that, although there is a definite relation between the severity of the process and duration of exposure and concentration of the dust, there was a constitutional factor which governed the degree of reaction of the patient to the irritant. The prognosis in well-defined pulmonary asbestosis is unfavorable, death occurring in approximately one-half the time after exposure that elapses in silicosis. Therapy is symptomatic. Removal of the dust hazard has been found occasionally not to influence the further progress of the disease.

A classification of the three stages of asbestosis was well outlined. However, many indefinable intermediate stages occur, and important generalizations are formulated as follows: In silicosis the oldest and most discrete lesions are found in the lateral and posterior subpleural regions of both mid-pulmonic fields, with evidence of regional lymph node reaction, whereas, in asbestosis, there is a diffuse chronic interstitial pulmonary fibrosis, beginning in the basal lung-fields, particularly on the right side. Asbestosis presents infraclavicular emphysema, slight hilar involvement,

and prominent accentuation of trunk markings, in contra-distinction to silicosis, in which there is epidiaphragmatic emphysema and prominent hilar involvement. The appearance of silicosis is variously described as "snow-storm," "sago soup," and of a shot-like appearance. In asbestosis there is a diffuse veil-like increased density with no coarse tumefactions which appear to be hard. In the presence of a double contour of pulmonic markings near the cardiac margin, asbestosis as well as bronchiectasis should be considered.

WILLIAM R. STECHER, M.D.

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A Few Rare Cases of Pulmonary Lymphogranulomatosis. Carlos Gil. Fortschr. a. d. Geb. d. Röntgenstrahlen, March, 1936, **53**, 246–251.

The author reports three cases of lymphogranulomatosis with pulmonary manifestations. Two of his patients were in the fifth decade of life, one in the first. It is very apparent that the roentgen images alone can be extremely misleading and that on their basis exclusively a correct diagnosis of lymphogranulomatosis can hardly be made because of the tremendous variability of anatomic and clinical manifestations. Biopsy and histologic investigation always will be necessary. Blood studies too frequently are unreliable, though an absolute and relative monocytosis is found frequently, while in earlier cases, especially in the juvenile form, a transient lymphocytosis may be observed. The disease may lead to the formation of cavities resembling tuberculosis and of tumor masses resembling carcinoma. The hope is expressed that a biologic reaction characteristic of Hodgkin's disease soon may be developed.

H. A. JARRE, M.D.

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The Three Zones of Simple Pleural Effusions. Julius Kaunitz. Am. Jour. Roentgenol. and Rad. Ther., January, 1936, **35**, 57, 58.

In effusions not complicated by consolidation, pneumothorax, or adhesions, there are three zones:

1. A radiopaque zone, made up of a large volume of liquid, displacing the lung upward and casting a dense curved roentgenographic shadow.

2. A radiotranslucent zone, consisting of a moderate volume of liquid, interposed between the lung and chest wall and casting a moderately dense roentgenographic shadow.

3. A radiotransparent zone, representing a film of liquid too thin to cast a roentgenographic shadow. This was proven by demonstrating injected oil in the pleural cavity floating some distance above the density of the apparent superior region of the effusion.

S. M. ATKINS, M.D.

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Asbestosis. A. J. Lanza. Jour. Am. Med. Assn., Feb. 1, 1936, **106**, 368, 369.

Asbestosis is a pneumoconiosis caused by the inhalation of asbestos dust. It is distinct from silicosis in its pathology and clinically. Asbestos (Canadian) is a hydrated magnesium silicate containing 43 per cent magnesium, nearly 13 per cent water, and traces of iron and nickel. Hoffman called attention to the possible harmfulness of asbestos dust in 1918, but it was not until February, 1927, that asbestosis was officially recognized. This was 27 years after the first fatal case was reported. In 1928 the British Factory Department conducted an investigation and enacted laws for the protection and compensation of the workers against this hazard. Since 1927 there have been eleven fatal cases reported in the United States, eight uncomplicated, and three complicated by tuberculosis. Pathologically, while silicosis is predominantly parenchymatous, asbestosis is mainly interstitial; nor is asbestosis characterized by the nodular formation so distinctive of silicosis.

Clinically, asbestosis presents the same dyspnea on exertion, the same dry cough, and the more or less indefinite physical signs characteristic of silicosis. The patient with asbestosis is apt to have clubbed fingers (not usually seen in silicosis), and he is apt to be pasty-faced and even show a slight cyanosis, while the silicotic patient is apt to be fairly robust looking. All the patients in whom asbestosis was detected were, with one exception, working steadily at their trades. In only one case was roentgenographic evidence of active tuberculosis found; several showed healed tuberculous lesions.

Examination of 126 workers, all of whom had more than three years' exposure, elicited indefinite and inconclusive roentgenographic evidence of pneumoconiosis. Four presented evident pulmonary symptoms and corroborative roentgenographic images. The x-ray appearances are not clear-cut or distinctive, as in silicosis; the shadows are finer, more granular and softer than in silicosis. The asbestosis film gives the impression of ground glass, and there is no nodulation with the consequent tendency of the nodules to coalesce and give dense opaque areas in the roentgenogram.

The shadows occupy the lower thirds, except in far advanced cases. Much more investigation and study of roentgenograms of industrial workers exposed to all sorts of silicate and other dusts are needed before it will be possible to speak definitely on this, the most important phase of the diagnosis of pneumoconiosis.

Associated with exposure to asbestos dust is the occurrence in the sputum and pulmonary tissues of a peculiar formation known as asbestos bodies. It is commonly agreed at present that they are not diagnostic of pulmonary fibrosis.

It is by no means certain that asbestosis progresses after withdrawal from dust exposure, nor does infection seem to be as closely and intimately associated with asbestosis as with silicosis.

CHARLES G. SUTHERLAND, M.B. (Tor.).

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Primary Carcinoma of the Lung: A Diagnostic Study of 135 Cases in Four Years. Aaron Arkin and David H. Wagner. Jour. Am. Med. Assn., Feb. 22, 1936, **106**, 587–591.

Cancer of the lung is one of the most important pulmonary diseases in persons past 40 years of age. It must always be considered in dealing with cases of lung abscess, bronchiectasis, recurrent pneumonia,

empyema, hemorrhagic pleurisy, and chronic pneumonia. Pain in the chest or in other parts of the body, accompanied by a cough and bloody sputum and sooner or later followed by dyspnea, is the cardinal symptom. An area of pulmonary infiltration or atelectasis, enlarged supraclavicular or axillary lymph nodes, a hemorrhagic pleural effusion, paralysis of a diaphragm or of one of the vocal cords, a Horner syndrome, and evidence of bone, brain, liver, or other metastasis make the diagnosis quite certain. Tuberculosis is usually easily excluded but may occasionally accompany lung carcinoma.

The roentgenologic signs are diagnostic in a high percentage of cases. The bronchoscope is of great value in confirming the diagnosis and in treatment. The finding of carcinoma in a biopsy from an enlarged lymph node, cervical or axillary, a bronchus, tissue in the sputum, sediment from a pleural effusion, or a piece of tissue obtained by thoracotomy completes the diagnosis. All carcinomas of the lung are bronchiogenic in origin. They arise in the trachea, bronchi, or bronchioles. There can be no primary carcinoma in the alveoli, as they have *no epithelial lining*. There are three types of carcinoma: (1) adenocarcinoma, (2) squamous cell, and (3) undifferentiated round or spindle cell. Some tumors may arise from the mucus-secreting glands of the bronchi. The round and spindle cell carcinomas were in the past often erroneously diagnosed as lung or mediastinal sarcomas.

In the experience of the authors lung cancer was one of the most frequent causes of osteoclastic bone metastasis.

Of 135 cases studied over a four-year period, 74 were confirmed by necropsy, 26 by biopsy, and 13 by bronchoscopy. Twenty-two were diagnosed from the characteristic clinical and roentgenologic manifestations.

CHARLES G. SUTHERLAND, M.B. (Tor.).

## LYMPHOGRANULOMA

Roentgen Therapy of Lymphoblastoma. R. Gaudu-cheau. Strahlentherapie, 1936, **56,** 407–412.

The author briefly discusses 10 cases of lymphoblastoma which came under his observation. Five involved the tonsillar region, three the nasal sinuses, two the cervical and supraclavicular areas. In the last two patients the primary focus could not be definitely determined. Whenever the presence of a lymphoblastoma is suspected 2 × 400 r (200 kv., 1 mm. Cu) are given prophylactically, followed by biopsy. If the biopsy is positive, from 2,000 to 3,000 r are added per field. Three of the patients discussed in the article are still alive. Two of these have remained free from recurrence for a period of 10 and 12 years, respectively.

ERNST A. POHLE, M.D., Ph.D.

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Destructive Doses in Roentgen Therapy of Lymphogranulomatosis. Nandor Ratkoczy. Strahlentherapie, 1936, **56,** 325–336.

The author believes that Hodgkin's disease is a chronic inflammatory infectious disease caused by some unknown fungus similar to actinomyces. He recommends, therefore, roentgen therapy in high doses applied according to the fractional dose method. Technic: 170 kv., 0.5 mm. Cu + 1 mm. Al, 50–60 cm. F.S.D., 12 r per minute, 200 r per day per field up to 2,000 r per area. He admits that occasionally the daily dose has to be reduced to 50 r and the interval sometimes has to be changed to two days. The author does not believe in prophylactic irradiation. During the intervals between roentgen therapy, As. and liver extract should be given. While these destructive doses will not cure Hodgkin's disease, they are recommended by the author because they may permanently destroy the involved glands.

ERNST A. POHLE, M.D., Ph.D.

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The Lymphomatoid Diseases (the So-called Lymphoblastomas). E. B. Krumbhaar. Jour. Am. Med. Assn., Jan. 25, 1936, **106,** 286–291.

Though the typical forms of a number of obscurely caused disorders of the lymphatic and hematopoietic systems, mostly associated with blood changes and tissue enlargements, are distinct, in no group of diseases are there so many variations of individual cases, with overlapping into another category and perhaps even transition from one disease to another.

With the inauguration of modern hematology several criteria were accumulated for the segregation of typical cases of the various leukemias; the picture of lymphosarcoma was definitely outlined in 1893 and the establishment of a special pathologic history gave an adequate diagnostic basis for most cases of Hodgkin's disease.

A number of other more or less obscure conditions, such as pseudoleukemia, leukosarcoma, granuloma fungoides, Mikulicz's syndrome, the chloromas, and more recently the reticuloses and giant lymph follicle hyperplasia, present either such obvious relationships to the group or such difficulties of differential diagnosis that they may well be grouped together under one heading.

The author suggests grouping all these under the non-committal and relatively brief title of the "lymphomatoid diseases." The classification and the individual diagnoses as far as possible should be on a pathologic basis. An analysis of 150 cases brought out various items of etiologic and pathologic interest.

The lymphomatoid diseases are practically all alike in having a fatal prognosis, though the duration may extend from a few days to many years. With few exceptions they are peculiarly susceptible to and improved by radiation treatment. The relative resistance of the reticuloses to radiation may prove useful in segregating this group.

CHARLES G. SUTHERLAND, M.B. (Tor.).

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Roentgen Therapy of Lymphogranulomatosis Inguinalis (Nicolas-Durand-Favresche Disease). D. Negru. Strahlentherapie, 1936, **56,** 298–304.

During the last 11 years the author has treated 40 cases of lymphogranulomatosis inguinalis: 30 could be followed up and are used for statistical evaluation. The results obtained in the individual cases are com-

piled in a table. Technic: 160–180 kv., 0.5 mm. Cu + 4 mm. Al, 30 cm. F.S.D., 10 × 15 cm. field, 200 r, one to three sittings at intervals of from four to six weeks. After an analysis of the results of the treatment the author states that roentgen therapy cures at least 50 per cent of these patients. The results are particularly good in non-purulent cases.

ERNST A. POHLE, M.D., Ph.D.

## OSTEOMYELITIS

Roentgen Therapy of Osteomyelitis. J. Palugyay. Strahlentherapie, 1936, **56,** 126.

The author treated 63 cases of chronic (35) and recurrent (28) osteomyelitis with roentgen rays. Technic: 160 kv., 0.5 mm. Cu, 40 cm. F.S.D., H.V.L.$_{Cu}$ 0.83 mm., 2–4 fields, 4–8 days' interval between sittings, surface dose 50–150 r, depending on the age of the patient. The results of the treatment were, as a whole, very encouraging. If a recurrent process was treated in the early stage, it healed without requiring further surgery. The chronic stage can be shortened by proper treatment. Osteomyelitis in the acute stage should not be irradiated but operated on.

ERNST A. POHLE, M.D., Ph.D.

## PEPTIC ULCER

Pyloric Off-centering, a Radiologic Sign of Gastroduodenal Ulcer. Albert Chapuy. Arch. d. Mal. de l'App. Digestif, May, 1936, **26,** 534–543.

Chapuy presents a pathognomonic sign of gastric or duodenal ulcer, namely, the placing off-center of the pylorus in relation to the axis of the antrum. In a normal stomach the pylorus is always in the symmetrical axis of the antrum and it may be very readily determined by observation with no mechanical aids, having the patient stand squarely facing the front. If the patient is turned slightly to the left, a false off-center observation may result and, if to the right, the stomach may mask the pylorus. Greater dependence is placed on fluoroscopic observation than on films. Questionable cases rarely arise and these are chiefly those in which the pylorus is placed behind the antrum, when a proper relationship cannot be established, and also in cases in which there is a high grade retention with pyloric stenosis. Possibilities of error are first, using the bulb and not the pyloric canal in relation to the antrum as a landmark; second, in long atonic stomachs with vertical displacement in cases in which the peristaltic movement cannot be readily traced, and third, the author observed one case of a tumor of the lesser curvature which gave this sign. At the same time, however, a large defect was observed and the diagnosis was apparent. The author quotes Sauvan who found the pylorus off-center in 19 of 34 duodenal ulcers and in 8 of 14 gastric ulcers. The sign is of no value in localizing an ulcer and he has never observed it in non-ulcerative lesions. Due to the fact that some retention has been found in all cases showing this sign, he believes it a prognostic index of pyloric stenosis and uses it as an indication for operative interference.

JOSEPH DAUKSYS, M.D.

Gastro-intestinal Allergy. IV. The Leukopenic Index as a Method of Specific Diagnosis of Allergens Causing Peptic Ulcer. L. P. Gay. Jour. Am. Med. Assn., March 21, 1936, **106,** 969–976.

The leukopenic index as a method of specific diagnosis of allergens causing peptic ulcer is based on the discovery of Vaughn that milk caused a leukopenia in patients subsequently found to be sensitive to milk. Certain foods producing allergic symptoms are able to depress the total leukocyte count, while compatible foods in general are followed by a rise in the total count. A positive balance indicates compatible foods, a negative balance indicates allergens. The method, though admittedly tedious, appears to be accurate to a high degree.

The author reports six cases in which a diet composed of compatible foods exclusively proved capable of giving complete relief from ulcer symptoms and freeing the patient from medication, from interval feedings, and from the necessity of hospitalization.

CHARLES G. SUTHERLAND, M.B. (Tor.).

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The Roentgen Diagnosis of Small Gastric Ulcers in the Region of the Cardia. C. W. Lohmann. Röntgenpraxis, January, 1936, **8,** 11–15.

The author's experience in ulcers of the stomach, situated close to or in the cardia, has shown him that their typical localization is predominantly on the posterior wall and about an inch below the cardia. They may be shown best by means of the relief method (niche and star-like deformity of mucosa). Re-examination after a short interval is always necessary to check them. Changes in size and disappearance of the niche after medical treatment are the best proofs for correct diagnosis. Small cardiac diverticula and pseudoniches may lead to errors.

H. W. HEFKE, M.D.

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Gastric Ulcer with Fatal Hemorrhage in the Newborn. Ralph H. Kunstadter and Eugene Gettelman. Jour. Am. Med. Assn., Jan. 18, 1936, **106,** 207–209.

A brief review of the literature discloses 64 reported cases of ulceration of the gastroduodenal mucosa during the neonatal period. Theile classified these as ulcerations associated with melena neonatorum. Berglund found 14 duodenal ulcers, four gastric ulcers, and one combined duodenal and gastric ulcer in 1,323 postmortem examinations of children up to 13 years of age. Of his patients, 70 per cent were in the first year of life. In 56 cases there were hemorrhagic erosions. Dietrich found 134 ulcers or scars of ulcers in 8,534 postmortem examinations, six of these in children less than 10 years of age, and one of them in an infant aged 10 days. Dunham and Shelton reported a case of multiple gastric ulcers in a new-born infant.

Mills recently reported a case of multiple gastric ulcers with hemorrhage in an infant six days old, revealed at autopsy. This infant first presented gastric intestinal symptoms on the fourth day. Blood in the vomitus and stools was first noted on the last day of life.

In Michael Reese Hospital, over a 20-year period, seven cases of gastroduodenal ulcerations were found in

infants under one year of age, two of them younger than one month.

The authors report two cases of persistent hematemesis of fresh blood with the onset occurring within the first thirty-six hours after birth.

CHARLES G. SUTHERLAND, M.B. (Tor.).

## THE PHARYNX

Roentgen Therapy of Hypertrophy and Focal Infection of the Lymphatic Ring in the Pharynx. R. Torres-Carreras and P. B. Sola. Strahlentherapie, 1936, **55**, 279.

The authors have irradiated the tonsils in 147 patients with "focal infection." This comprised a group of patients with chronic tonsillitis, focal infection and swollen glands, pharyngitis, enlargement of hilum glands, laryngitis, abscesses, rheumatism, circulatory disturbances, disorders of the digestion, kidney disease, blood disease and patients with symptoms of focal infection after tonsillectomy. The total doses given per area (left and right angles of jaw) amounted to from 300 to 3,000 r; the field size varied from 12 to 48 sq. cm., according to the age of the patient. Six sittings were usually given at intervals of three or four days for the first four, and 14 days before the last two. The authors believe that a new series can be given from six to twelve months later. Of the 132 patients who responded to the treatment, 15 were not benefited. Numerous schematic drawings of the pharynx before and after treatment are shown in the article.

ERNST A. POHLE, M.D., Ph.D.

## PNEUMOTHORAX

Medico-thorax—A New Method of Pneumothorax Therapy. Wilhelm Müller. Schweiz. med. Wchnschr., Feb. 29, 1936, **66**, 225–227.

The author employs antiseptic-laden air in lieu of the ordinary air in artificial pneumothorax therapy. An apparatus for producing this admixture is described, the important antiseptic constituent being trypaflavin. This method effectively prevents pleural exudation, as is commonly noted in ordinary pneumothorax procedures. By absorption of the medicament, locally and generally, there is increased rapidity of healing of the tuberculous process, as is noted in rapid subsidence of fever and disappearance of positive bacilli. The method is intimated to be a veritable *sterilisatio magna* of the lung.

WILLIAM R. STECHER, M.D.

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Roentgenologic Demonstration of Pleuritic Bands in a Pneumothorax. Karl Hohenner. Röntgenpraxis, January, 1936, **8**, 1–11.

Since the introduction of artificial pneumothorax and of the endoscopic cutting of adhesions, it has been of great importance to be able to determine the extent and location of pleural bands in order to use these new methods. Fluoroscopy and films are necessary to get an accurate picture. Films in at least two directions are usually necessary to determine the exact location of a localized adhesion which may be cut by endoscopy. The adhesive bands which are of greatest importance in this respect are usually situated in the upper portions of the chest and are amenable to a correct roentgen interpretation.

H. W. HEFKE, M.D.

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Pneumothorax in the New-born. J. van Ebbenhorst Tengbergen. Fortschr. a. d. Geb. d. Röntgenstrahlen, March, 1936, **53**, 240–245.

This is a report of three cases of pneumothorax in new-borns, with an extensive review of pertinent literature. The three children recovered.

The assumption that, in large fetuses with abnormal twisting of the umbilical cord, premature efforts at respiration occur and lead to a pulmonary trauma must be regarded as debatable.

H. A. JARRE, M.D.

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Post-operative Massive Collapse of the Lung. Josef Meese. Röntgenpraxis, March, 1936, **8**, 173–176.

An atelectatic collapse of a lung or portion of a lung is due to bronchial obstruction. In the case of post-operative collapse, hypoventilation and formation of mucus and secretion, with decreased expectoration, is probably the most common cause. The roentgen signs are typical: a dense homogeneous opacity of one or more lobes, elevation of the diaphragm, and displacement of the heart and mediastinum toward the diseased side. Shrinking of the involved lung and edema are responsible for the x-ray findings.

H. W. HEFKE, M.D.

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The Increasing Importance of Pneumothorax Therapy in Pulmonary Tuberculosis. J. W. Cutler. Jour. Am. Med. Assn., April 18, 1936, **106**, 1366–1373.

Artificial pneumothorax was suggested as a form of treatment for pulmonary tuberculosis by James Carson, in England, in 1821, but until recently collapse therapy has made relatively little progress in this country.

Pneumothorax has been regarded as a sanatorium procedure; the recognized indications were narrow, and the number of cases comparatively few. With the rapidly increasing application of all forms of collapse therapy, therapeutic pneumothorax is now probably overdone.

Intensive local rest for an indefinite time only can control the toxemia and its constitutional manifestations and this can best be accomplished by collapse therapy. This shuts off the source of the toxemia and further absorption of toxic products is eliminated. For this reason the immediate results of artificial pneumothorax are often dramatic.

Experience has shown that in a majority of cases from three to five years is necessary to effect a cure and in some cases longer. Pneumothorax should be continued for at least a year after the x-ray evidence indicates complete healing.

Artificial pneumothorax must be regarded as a public health measure of the first magnitude.

Improvement in technic has materially increased the usefulness of artificial pneumothorax and widened its indications. Contra-indications are hypertension and heart disease or cardiac decompensation. As a rule, patients beyond 50 years are easily upset when the intrapleural pressure is changed by pneumothorax therapy. Extensive adhesions contra-indicate pneumothorax, but such patients may be helped by phrenicectomy or thoracoplasty.

Complications are air embolism, pleural shock, pleural diffusions, spontaneous pneumothorax, and disease in the contralateral lung, and these are discussed in detail.

CHARLES G. SUTHERLAND, M.B. (Tor.).

## THE PROSTATE

Leiomyoma of the Prostate Gland. Frank S. Patch and Lawrence J. Rhea. British Jour. Urol., September, 1935, **7**, 213–228.

The authors find that leiomyomatous nodules are frequently seen in association with adenomatous enlargement of the prostate. They report an incidence of 25.4 per cent in a series of 181 consecutive cases examined. This high percentage may be directly attributed to their method of examining the prostate and the differential staining employed. A reproduction of the urinary tract with its associated pathology, as well as several photomicrographs of the gland sections in this case are presented.

D. H. PARDOLL, M.D.

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Prostatectomy with Closure: Addenda and Some Observations. S. H. Harris. British Jour. Surg., April, 1936, **23**, 816–819.

The author makes some observations on the procedure of prostatectomy with closure which he recommended some two years ago. There are certain modifications which have been introduced and which should be beneficial to surgeons employing this method.

DAVIS H. PARDOLL, M.D.

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A Large Leiomyoma of the Prostate. T. M. Mimpriss. British Jour. Surg., April, 1936, **23**, 863–865.

The author reports a case of leiomyoma of the prostate which weighed 19 ounces. Reproductions of the tumor and microscopic sections are included in the article.

DAVIS H. PARDOLL, M.D.

## RADIATION EFFECTS

A Contribution to Total Teleroentgen Therapy. L. Siciliano. Strahlentherapie, 1936, **56**, 351–353.

The author briefly discusses the history of general body exposure which was inaugurated by Dessauer in 1905 and revived by Teschendorf in 1927. He suggests for economical reasons to divide the body surface in two or three parts rather than to treat one surface at a time at long distance. The treatment will consume less time if more areas are used. He accepts the rationale of general body exposure in leukemia but cannot quite agree to its use in Hodgkin's disease. He does not irradiate normal glands but only those which are definitely involved. In polycythemia, he also objects to the use of general body exposure because only the bone marrow should be treated and not the spleen. As a matter of fact, its function should not be disturbed in this disease.

ERNST A. POHLE, M.D., Ph.D.

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Some Biological Results of Roentgen Therapy of the Hypophysis. A. Lambadaridès. Strahlentherapie, 1936, **56**, 273–277.

The author relates his experience with roentgen therapy directed to the hypophysis in 22 women suffering from ovarian dysfunction; in some menstruation had stopped and some of the patients never had menstruated before. Technic: 180 kv., 3 ma., 50–60 cm. F.S.D., left and right temporal area, 5 × 5 cm., 0.8 mm. Cu + 2 mm. Al. During a period of from several weeks to three months, a total of 2,000 to 2,400 r was applied. The results were most gratifying. The author also treated with the same method several men aged over 50 years; their general condition and potence improved (?).

ERNST A. POHLE, M.D., Ph.D.

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Contribution to the Treatment of Ischias. Walter Altschul. Strahlentherapie, 1936, **56**, 181–183.

The author recommends as the best method of radiation therapy of ischias a combination of roentgen therapy to the roots and injection of radium chloride to the nerve. He uses one or two fields, applying 200 r, filtered through 4 mm. Al. Fourteen days later six injections of from 1 to 2 mc. of radium chloride, administered daily, are given. This method is, in the author's opinion, superior to diathermy.

ERNST A. POHLE, M.D., Ph.D.

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The Problem of Dosage in Radiation Therapy. Ralston Paterson. Strahlentherapie, 1936, **56**, 478–487.

This is a critical analysis of the physical part of the problem of dosage in radiation therapy: quality, quantity, and intensity of radiation.

ERNST A. POHLE, M.D., Ph.D.

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Modification of Radiosensitivity by Means of Readily Penetrating Acids and Bases. R. E. Zirkle. Am. Jour. Roentgenol. and Rad. Ther., February, 1936, **35**, 230–237.

Using the spore of the fern *Pteris longifolia* and also *Paramecium*, it was noted that an increase of the acids carbon dioxide and hydrogen sulphide up to a certain concentration increased the radiosensitivity and beyond that point, a decrease, while the base ammonia acted in the reverse manner. These chemicals produced no detectable effects without the irradiation.

Clinical application of the above results depends

upon whether mammalian tissues will respond in the same way, both to the chemicals and to irradiation, and also whether such response will be without harm to normal tissue.

S. M. ATKINS, M.D.

## RADIOLOGY, PRACTICE OF

Plato and the Radiologists. T. Rees. München. med. Wchnschr., April 24, 1936, **83,** 671–673.

The author recounts the classical tale of Plato, in which the people could see only the shadows of personages, and when one was freed to see the actual person he was amazed and dismayed, considering the shadows to be really the actual entity. A simile is cleverly drawn to roentgenologists, who are students of "shadow pictures." Great stress is placed upon reliance not only upon pure roentgenologic evidence, but history, and evaluation of signs and symptoms. This is most important in gastro-intestinal roentgenology, in which such confusing and seemingly divergent diagnoses are established upon the same person upon successive days of examination. Excellent illustrations of this are given, and in the case of the ulcer niche, the author suggests the possibility of a blood clot or inspissated mucus, filling the ulcer crater, which would prevent its visualization. The author recounts interesting stories of radiologists, one of whom deplored the fact that without a modern rotating target roentgen tube and high-powered equipment, proper examination was impossible, even in regard to such a common examination as that of the gall bladder. Unquestionably the trend of to-day is toward greater refinement and advancement in the technical equipment of radiology, rather than toward a more thorough knowledge of the fundamental pathologico-anatomical concept of disease.

It is of great importance not to make an unqualified dogmatic diagnosis, especially in gastro-enterologic work, when a re-examination is feasible. In concluding, he warns that we, as radiologists, as in Plato's shadow fable, must strive to become aware of our inherent limitations in pure roentgen diagnosis, and, the greater the scope of one's radiologic acumen becomes, the more cautious one is, in arriving at a conclusive diagnosis.

WILLIAM R. STECHER, M.D.

## RADIUM

Radium Content of Rocks. W. D. Urry. Jour. Chem. Phys., January, 1936, **4,** 40–48 (Reprinted by permission from Science Abstracts, Sect. A, Physics, Feb. 25, 1936, No. 458, p. 133.)

The determination of the age of common rocks by the "helium method" necessitates accurate measurements of the radium content. The method of compensating the background by the use of two opposed ionization chambers is applied to radium determinations and the apparatus has an observational limit of $5.5 \times 10^{-14} \times n^{-1/2}$ gm. radium for $n$ hourly readings. With the Th content determined as above, results for a suite of rocks from a single horizon and the present status of a geological time scale are given.

AUTHOR

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Excitation of $\gamma$-rays by Neutrons (Part II). S. Kikuchi, K. Husimi, and H. Aoki. Phys. Math. Soc., Japan, Proc., January, 1936, **18,** 35–49. (In English.) (Reprinted by permission from Science Abstracts, Sect. A, Physics, April 25, 1936, No. 460, p. 363.)

The $\gamma$-rays emitted by proton-neutron interaction are observed. The cross-section for the process is found to lie between $1.0–0.36 \times 10^{-25}$ sq. cm. The energy of the $\gamma$-ray quantum emitted by this interaction is determined by the method of coincidence of two counters and is found to be $(2.2 \pm 0.1) \times 10^6$ eV. The absorption curves of the secondary electrons due to $\gamma$-rays excited in Cd, Cl, Cu, and Fe by slow neutrons are also determined. In the case of Cd, Cu, and Fe, $\gamma$-rays of more than $1 \times 10^7$ eV in quantum energy were observed.

AUTHORS

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Radio-activity of the Atmosphere. G. Aliverti. Gerlands Beitr. z. Geophys., 1935, **46,** 223–226. (In Italian.) (Reprinted by permission from Science Abstracts, Sect. A, Physics, Feb. 25, 1936, No. 458, p. 133.)

The results obtained by the author's apparatus have to be corrected by factors 1.10 and 1.17 for D.C. and A.C., respectively. This agrees for D.C. with the work of Illing and Malek using a similar apparatus but their correcting factor for A.C. is 1.99. To test the accuracy, the author uses two consecutive identical pieces of apparatus and comes to the conclusion that (except for radon) there are no radio-active atoms in the atmosphere. He points out the sources of error in Illing and Malek's apparatus and concludes that his own gives a quick and sufficiently accurate measurement of the radon content of the air.

H. M. B.

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Contribution to the Technic of Radium Therapy in Carcinoma of the Cervix by Means of Exteriorization of the Small Pelvis. Frans Daels. Strahlentherapie, 1936, **56,** 380–388.

The author has developed an operative technic which permits exposure of the pelvic organs so as to make possible irradiation of its entire volume by means of distributed radium screens. Human serum is poured in the pelvis following laparotomy in order to keep the peritoneum in good condition for 20 days or longer. During that period the radium applications are carried out. So far, the mortality has amounted to 10 per cent; the author is hopeful, however, that this can be reduced. While no statistical evaluation of the method can be given, Daels is convinced that it is superior to vaginal and cervical application of radium.

ERNST A. POHLE, M.D., Ph.D.

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Radium Therapy of Carcinoma of the Cervix from 1923 to 1934. J. W. F. Heukensfeldt Jansen. Strahlentherapie, 1936, **56,** 249–258.

The author presents a statistical analysis of 371 pa-

tients with carcinoma of the cervix. The radium technic used followed that of Regaud. Roentgen therapy was given only if there appeared to be parametrial involvement. On from 12 to 14 successive days there was given a total dose of 800 r over one anterior and one posterior field. More recently this dose has been increased. The statistical data are compiled in four tables and one graph. It is concluded that out of 371 patients with carcinoma of the uterus, 148 remained free from symptoms for a five-year period, which corresponds to a 35.1 per cent clinical cure. The primary mortality amounted to 3.2 per cent if *all* deaths were included.

ERNST A. POHLE, M.D., Ph.D.

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Properties of Radio-active Series. E. Lopoukhin. Phys. Zeits. d. Sowjetunion, 1936, **9,** 27–33. (In French.) (Reprinted by permission from Science Abstracts, Sect. A, Physics, May 25, 1936, No. 461, p. 488.)

With the help of recent models of the nucleus it is shown that the series of radio-active elements exhibit three consecutive phases of disintegration. In addition to these, certain other formal conditions are established for determining the course of alpha or beta disintegration.

N. M. B.

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Yield of Emanation from Radium-bearing Rocks to Flowing Water. H. Mache and G. Markstein. Akad. Wiss. Wien, Ber., 1935, **144,** 2a. 7–8, 489–492. (Reprinted by permission from Science Abstracts, Sect. A, Physics, Feb. 25, 1936, No. 458, p. 133.)

The paper describes experiments carried out to test how the quantity of emanation given up by a solid radio-active material to flowing water depends on the concentration of emanation in the water, the temperature of the water, and the grain size of the material.

W. E. P.

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Recrudescence of Ovarian Function after Heavy Irradiation: Two Cases. George Van S. Smith. New England Jour. Med., April 9, 1936, **214,** 725–727.

The author reports two cases of cyclic uterine bleeding following 2,400 and 6,000 milligram-hours of radium, respectively. Biopsies revealed functioning endometrium and thus a recrudescence of ovarian function. The author gives these findings as presumptive evidence for the development *de novo* of ovarian follicles after a long period of quiescence.

W. H. GILLENTINE, M.D.

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Apparatus for Direct Determination of Radon in Water and Air. F. Behounek. Phys. Zeits., March 15, 1936, **37,** 203–208. (Reprinted by permission from Science Abstracts, Sect. A, Physics, May 25, 1936, No. 461, p. 490.)

The paper first describes apparatus for determining the concentration of Rn in water. The sample is drawn into a vertical cylinder (0.25 l.) which is connected with the ionization chamber through a tap and a small tube. The water is atomized as it emerges from the tube and the expelled emanation is drawn into the ionization chamber. The latter is connected to a Lindemann electrometer, provided with a projection system, the scale of which is calibrated in Mache units, two ranges 0 to 70 and 0 to 700 Mache units being available. A portable apparatus incorporating a Lindemann electrometer and a compensating device is also described for the direct determination of Rn in samples of air.

W. E. P.

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Measurement of Small Quantities of Radon. H. Garrigue. Jour. de Physique et le Radium, February, 1936, **7,** 107–109. (Reprinted by permission from Science Abstracts, Sect. A, Physics, No. 461, p. 489.)

The author describes a light, portable, and robust apparatus for measuring the Rn content of air. The air is introduced into a previously evacuated cylindrical vessel containing an insulated charged rod. The fall in potential of the rod due to the ionization produced by the Rn is measured by a small Coulomb balance.

W. E. P.

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An Automatic Apparatus for Direct Determination of the Radon Content of Radio-active Waters to be Used for Therapeutic Purposes. F. Behounek. Strahlentherapie, 1936, **56,** 361–365.

The radio-activity of water is usually measured by the gamma-ray method. While this is a fairly simple procedure, one has to wait several hours before the decay products of radium have reached a state of equilibrium. It also requires at least 10,000 Mache units in the water to be examined. The customary radio-active bath, however, does not contain more than 200 to 1,000 of these units; consequently the use of this measuring method would require large quantities of water. The author has constructed, therefore, an apparatus which permits the determination of from 2–700 Mache units within 10 minutes. Several ionization chambers are connected to an electroscope, allowing for a wide range of radio-activity. The radon content is determined directly in the vaporized water. The apparatus and its manipulation are described in detail, several diagrams illustrating the construction.

ERNST A. POHLE, M.D., Ph.D.

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Gamma-ray Therapy of Tuberculous Peritonitis. O. Chance. Strahlentherapie, 1936, **56,** 33.

The author treated patients with turberculous peritonitis with either gamma rays or radium or roentgen rays. Radon tubes (50–70 mc.), distributed in 20 tubes with 0.6 mm. Pt filter, are arranged on a felt mold 1 cm. in thickness and 12 cm. in diameter. Three or four fields are given over the anterior abdomen with from 9 to 12 med. per area. This produces a very mild erythema on the skin. Of the 42 patients treated, 31 received one, 7 two, 3 three, and 1 four exposures.

The roentgen technic was as follows: 180 kv., 6 ma., 40 cm. F.S.D., 1 mm. Cu (H.V.L. $_{Cu}$ = 1.54 mm.), 200 r surface dose per field once a week for eight weeks. This series may be repeated at intervals of three months

While the testicles in men and, if possible, the ovaries in women are protected during irradiation, there is still danger of sterilization with this type of treatment. In only one instance did amenorrhea occur but menstruation was re-established after eight weeks.

An analysis of the results is given only of 42 cases treated with radium. Twenty-nine (69.05 per cent) were alive from one to five years following treatment. Compared with statistics giving the end-result following operation and light therapy, these figures are very encouraging. As advantages of the radium therapy the author lists the following: equally good or better results as from other treatment methods; duration of treatment only from three to six days, a repetition necessary in a few cases; treatment can be given in the hospital where the patient was admitted for diagnosis; the patient may remain in bed and improvement is noted usually much quicker than after roentgen or ultra-violet therapy.

ERNST A. POHLE, M.D., Ph.D.

## THE RECTUM

Roentgen Therapy of Carcinoma of the Rectum Surgically Exposed for External Treatment. H. Chaoul. Strahlentherapie, 1936, **56,** 377–379.

At the surgical clinic of the University of Berlin a method has been developed within the last few years which permits the direct surface treatment of carcinoma of the rectum by roentgen rays. Following colostomy the tumor is exposed by opening the rectum in its length and sewing it into the sacral wound. Treatments are given daily according to Chaoul's method (relatively low voltage, F.S.D. of 5–8 cm.). The daily dose varies between 400 and 500 r. This is continued until the tumor has disappeared—in the average case it requires a total dose of from 10,000 to 15,000 r. If after two or three months' observation there is no recurrence, the colostomy is closed again. During the last two years, eight patients have been treated in this manner. All were inoperable except one borderline case. In five, the tumor disappeared; one has a residual mass, and two are still under treatment. The first two patients treated are still well now after a two-year period.

ERNST A. POHLE, M.D., Ph.D.

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Intrarectal Radiography (Method, Apparatus, Technic, Indication, and Results). B. Sabat. Fortschr. a. d. Geb. d. Röntgenstrahlen, 1936, **53,** 143–165.

This is the description of a rectoradiograph, which permits the unfolding of a rolled-up film 45 × 50 millimeters in diameter in the rectum under the protection of an inflated rubber balloon. A correct exposure is ascertained by a centering device, exposures being made either postero-anteriorly for study of the coccyx or in the opposite direction for study of some of the pelvic organs.

This paper is illustrated by 68 very excellent reproductions, most of them showing anomalies and pathologic conditions of the coccyx, among the latter chiefly various types of fractures and dislocations of the coccygeal vertebral segments, injury to the coccygeal synchondroses, paracoccygeal ossifications and calcifications, disfigurations and deformities of the coccyx, hyperostoses, osteophytes, and deforming spondylitis; furthermore, changes of the spongeous structure which in some cases is limited to extremely small areas, infection with small abscesses and sequestration in the bones, dermoid cysts, pressure atrophy, etc.

All this information is of great value in the differential diagnosis of the troublesome coccydinia. Inasmuch as no two coccyges are alike, the method has criminologic value for identification of individuals. The rectoradiograph is quite an ingenious device which should find a ready field of application in this country, especially as it might also be applied to a number of other investigations, including investigation of various organs during surgical procedures.

H. A. JARRE, M.D.

## RICKETS

Multiple Intracerebral Foci of Calcifications. W. Müller. Fortschr. a. d. Geb. d. Röntgenstrahlen, 1936, **53,** 30–34.

This report concerns a rachitic dwarf afflicted with a severe epilepsy, who had also suffered a serious cranial trauma eight years prior to his death.

Multiple, densely grouped intracerebral calcifications were observed, particularly in the nucleus caudatus, cutamen, pallidum, and in the nucleus of the cerebellum. They could not be explained on the basis of arteriosclerosis, but represented capillary and periarterial calcifications up to the size of cherry-pits. The etiology could not be elicited but a connection was thought of between these calcifications and previous severe rickets which might have led to a general disturbance of calcium metabolism.

H. A. JARRE, M.D.

## ROENTGEN-RAY BURNS AND INJURIES

The Treatment of Radiodermatitis and its Malignant Complications. H. Bordier. Strahlentherapie, 1936, **56,** 205–214.

The author discusses the various types of injuries following irradiation, differentiating those appearing after treatment and those appearing as a professional injury. In their treatment he recommends diathermy; in fatty tissue medical diathermy, in other tissue, for instance, face, hand, and leg, electrocoagulation. Dressings are applied with a gauze saturated with 1 per cent phenol and changed daily. The wounds are rinsed with 1 per cent phenol plus 7‰ NaCl solution. All lesions with malignant degeneration are thoroughly coagulated. Some authors have also seen good results by the appli-

cation of infra-red rays; however, the author prefers diathermy.

ERNST A. POHLE, M.D., Ph.D.

## ROENTGEN-RAY THERAPY

The Heat Effect in Short Wave Therapy. H. Korb. Strahlentherapie, 1936, **55,** 686.

The author describes a quartz-benzol thermometer which can be used for temperature measurements on the skin and inner organs during electric short wave therapy. It appeared that with a wave length of 4.2 meters, when applying the electrodes over the bladder, the temperature within the bladder increased from 37.6° to 38.25° C. A further increase to 38.35° led to a burning sensation. The highest temperature was recorded after from eight to eighteen minutes. The body temperature as measured under the tongue increased from 36.8° to 37.2°. This shows that considerable local increases of temperature cannot be expected, undoubtedly due to the fact that the circulating blood prevents overheating.

The author states emphatically that short wave therapy should not be used in malignant tumors and quotes two illustrative case reports. A special table suitable for treating the pelvis is briefly described.

ERNST A. POHLE, M.D., Ph.D.

## SARCOMA

Radiation Therapy of Sarcoma, Particularly of Bone Sarcoma. Grashey, Glauner, and Meese. Strahlentherapie, 1936, **56,** 234–248.

During the period of 1928–1933, 39 cases of sarcoma were treated at the Roentgen Institute of the University of Cologne. Twenty-eight involved soft tissues. One patient is still alive after three years, one after four years, and three after five years, with lesions as follows: a round-cell sarcoma in the cervical region, a spindle-cell sarcoma of the thigh, melanosarcoma of the toe, fibrosarcoma of the arm, and a mixed cell sarcoma of the antrum. This corresponds to a three-year cure of 17.7 per cent and a five-year cure of 10.7 per cent. All diagnoses were verified by biopsy. Of 11 treated cases of sarcoma of the bone, two remained well for five years. Brief case histories of these patients are appended. Doses as high as 5,700 r to the tumor and 2,100 r to the regional glands were given. From their observations the authors conclude that simple removal of the sarcoma followed by intense roentgen therapy is at present the best method of treatment.

ERNST A. POHLE, M.D., Ph.D.

## SILICOSIS

Tripoli as a Source of Silicosis. Carey P. McCord. Jour. Am. Med. Assn., March 14, 1936, **106,** 913, 914.

Tripoli (rotten stone) designates a form of silica much used in industry. It is widely described as amorphous, but at least some varieties are crystalline, although the crystals are so minute as to warrant the term "cryptocrystalline." Tripoli, when air-dried in lamps, is a light, fine-textured, minutely porous rock, the individual grains approximately 0.0004 inch in diameter and consisting of 99 per cent silica.

It is rarely the cause of clinical silicosis. In experimental investigation it readily produces proliferative reactions when injected into the peritoneal cavity of guinea pigs. In all respects the responses obtained are similar to those produced by quartz or amorphous silica, similarly introduced. The electrostatic charge of tripoli particles, which tends to the formation of small clumps or masses of this suspended dust, may in some measure contribute to the low order of atmospheric dustiness in tripoli work places, and consequently to the low incidence of silicosis from this substance.

CHARLES G. SUTHERLAND, M.B. (Tor.).

## THE SINUSES

The Radiologic Investigation of the Superior Maxillary Antrum. E. H. Shannon. Jour. Am. Med. Assn., Feb. 22, 1936, **106,** 599–601.

Pathologic processes of inflammatory type within the antrum manifest themselves in several ways: by production of pus, by thickening of the mucoperiosteum, by polypoid degeneration or cyst formation, and by reaction changes in the bony walls. These processes may be identified with considerable accuracy in "plain" x-ray films. The use of iodized oil is rarely necessary and may completely obscure a valuable indication of disease, the condensing osteitis seen in cases of chronic suppuration and the rarefying type commonly associated with chronic polypoid degeneration of the mucous membrane.

An estimate of the accuracy of the method is attempted as checked by the results in 296 patients in whom the radical antrum operation was performed.

Chronic maxillary sinusitis in even repeated subacute infections may fail to cause local symptoms and may remain unsuspected, even though productive of systemic symptoms from direct absorption of toxins or by secondary infections in the joints, the chest, or elsewhere.

Transillumination may be negative even in the presence of an antrum full of mucoid material or polyps. The antrum may be more brightly illuminated on the diseased than on the normal side, probably because of coincident decalcification of its walls. An old healed infection cannot be distinguished by transillumination from one that is recent or active.

The radiologic examination of the maxillary antrum is seldom necessary in the presence of an acute infection. Initially there is a slight decrease in brilliance of all the sinuses. With pus formation, a more or less uniformly

dense shadow is produced which almost obliterates the superimposed skull markings if drainage is completely blocked. With incomplete drainage, the antrum may be partially filled with exudate, with air overlying.

Differential features of examination in the prone and erect positions are informative. Reactive changes in the antral walls should provide a clue as to the presence of pus; one must at times rely on this as the sole means of differentiating between empyema and retention cyst as between an antrum containing polyps and one that harbors both polyps and pus.

In chronic suppuration the marked degree of condensing osteitis is typical of the condition.

CHARLES G. SUTHERLAND, M.B. (Tor.).

## THE SKULL

Hereditary Occurrence of Enlarged Parietal Foramina: Their DiagnosticIm portance. O. H. Perry Pepper and Eugene P. Pendergrass. Am. Jour. Roentgenol. and Rad. Ther., January, 1936, **35,** 1–8.

The parietal bone frequently exhibits near its upper posterior angle a minute pinhole foramen through which an emissary vein passes. This parietal foramen is very often wanting and, when visible, may be closed. Sometimes it may be double. At times, it may be markedly enlarged and can then be palpated and shown roentgenologically.

Clinically the anomaly is of only slight importance although the defect might be found and misinterpreted. It is shown by the authors' cases and the literature that this anomaly is hereditary and although not common, is not very rare.

S. M. ATKINS, M.D.

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Histologic Control of Roentgen Images in a Case of Tumor of the Epipharynx. L. Kraus. Fortschr. a. d. Geb. d. Röntgenstrahlen, 1936, **53,** 114–121.

In the case of an advanced carcinoma of the epipharynx, roentgen studies of the temporal bones and of the sella turcica were compared with serial histologic sections. It was shown that essentially the roentgen demonstration of the destruction and invasion was quite correct and only minor inconsequential detail was not observed roentgenologically; of the latter, one might mention a small area of local sclerosis in the floor of the sella. Incidentally, this paper well illustrates the value of well-done Stenvers' projections. Furthermore, it should stimulate workers, especially roentgenologists, to more frequently compare autoptic material with their roentgen records and interpretation.

H. A. JARRE, M.D.

## THE SPINAL CORD

The Roentgen Diagnosis of Tumors of the Spinal Cord. E. Busch and H. Scheuermann. Fortschr. a. d. Geb. d. Röntgenstrahlen, 1936, **53,** 107–114.

This paper contains a confirmation of the work of Elsberg and Dyke. (See roentgen-ray diagnosis of spinal cord tumors by Cornelius G. Dyke in Diagnostic Roentgenology, by Ross Golden; Thomas Nelson and Sons, New York and Edinburgh, 1936.)

The distance of the vertebral pedicles was found to be a realiable localizing sign in 10 meningiomas out of 17 reviewed, in seven neurinomas out of 11, and in three cases of intramedullary glioma. In several additional cases important conclusions also could be drawn from a study of the structural appearance of the pedicles, especially in cases of extradural tumors. Myelography could not be dispensed with in a number of cases and in an additional series was utilized as an excellent means of confirmation of the diagnosis. However, this procedure should not be utilized and interpreted indiscriminately as it could be misleading.

H. A. JARRE, M.D.

## THE STERNUM

A Case of Congenital Bifid Sternum. E. Kewesch. Röntgenpraxis, February, 1936, **8,** 100, 101.

This is a report of a case of congenital bifid sternum, involving the manubrium and corpus. The ensiform process was absent; there was a congenital scar in the middle of the abdomen between the end of the sternum and the navel, which indicated an anomalous development of the abdominal wall.

HANS W. HEFKE, M.D.

## THE STOMACH

Giant Rugæ (Localized Hypertrophic Gastritis) Resembling Carcinoma. John L. Kantor. Am. Jour. Roentgenol. and Rad. Ther., February, 1936, **35,** 204–207.

Two cases of giant rugæ (localized hypertrophic gastritis) are described and the roentgen appearance illustrated. Both cases showed resemblance to carcinoma of the greater curvature, yet both were proved to be benign at operation.

In the presence of similar roentgen findings the differentiation between carcinoma and hypertrophic gastritis may be made by repeated roentgen observations, with careful correlation of clinical findings. However, in certain instances, exploratory operation may nevertheless prove unavoidable. Exploratory operations may be minimized in the future by better acquaintance with the clinical, pathologic, and especially with the roentgen manifestations of advanced localized hypertrophic gastritis.

S. M. ATKINS, M.D.

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Roentgen Therapy for Ulcers of the Stomach and Duodenum. R. K. Kruglikowa, M. L. Katscher, and M. L. Awiossor. Röntgenpraxis, March, 1936, **8,** 179–182.

Over two hundred reports about roentgen therapy for gastric and duodenal ulcers are to be found in the literature; some of them are favorable, some of them

declare it useless. The authors have treated 46 cases. Pain, nausea, vomiting, hyperacidity, etc., disappeared very soon or became much less, shortly after roentgen treatments. A mild diet was maintained during and for a few months after treatment. The action of the rays on the ulcer is probably complex (decrease of secretion, anti-inflammatory action, specific influence on the nervous system). Three treatments were given (160 kv.) to the stomach, two anterior and one posterior, each consisting of one-third of an erythema dose. After two weeks the series was repeated. In 31 of the 39 cases, the gastric acidity decreased (determined by gastric lavage). The authors are of the opinion that roentgen therapy is a valuable method of treatment for gastric and duodenal ulcers.

H. W. HEFKE, M.D.

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Two Cases of Diverticulum of the Cardiac Portion of the Stomach. Ledoux-Lebard, P. Hillemand, Garcia Calderon, and W. Aubrun. Arch. d. Mal. de l'App. Digestif, May, 1936, **26,** 527–533.

Two cases of diverticulum of the stomach, both near the cardiac orifice of the stomach and placed anteriorly, were discovered in routine examination of patients who had post-prandial distress accompanied by profuse intestinal hemorrhage. The pathology was best seen in the lateral prone position.

Of interest is the speculation of the authors, based on studies of the stomach forms of different animals (to be published later), that the gastric diverticulum of the cardiac portion of the stomach may possibly be an abnormal survival of a characteristic normal in the phylogenic series.

JOSEPH DAUKSYS, M.D.

## THE SUPRARENALS

Histological Changes in the Suprarenals Following Roentgen Therapy. R. B. Engelstad. Strahlentherapie, 1936, **56,** 58.

The author reviews the literature regarding the effect of roentgen rays on the suprarenals. Because of the discrepancies in the reported findings he undertook a series of investigations of his own. Thirty-one rabbits were exposed to roentgen rays; five animals served as controls. Technic: 170 kv., 4 ma., 0.5 mm. Cu + 1 mm. Al, 27 cm. F.S.D., 3 × 4 or 4 × 6 cm. field size, from 125 to 4,500 r. At varying intervals following the treatment the animals were killed and the suprarenals studied histologically. After doses just below the skin tolerance (1,500 r) very few changes could be demonstrated in the cortex. There was occasional hyperemia, lymphocytic infiltration, and very few nuclear injuries. After higher doses, which produce a definite epidermitis, the degeneration of the cortical cells was definite: 17 or 18 days after a dose of 3,000 r these changes are to be found in almost the entire cortex. As far as the time element is concerned, no definite changes could be found during the first two weeks after the treatment. After 15 days beginning degeneration was apparent, accompanied by hyperemia, and this was fully developed after 17 or 18 days. The reaction seemed to reach its peak in the second month and then to recede slowly, followed by fibrosis.

ERNST A. POHLE, M.D., Ph.D.

## SYPHILIS

The Lag Phase in Early Congenital Osseous Syphilis: A Roentgenographic Study. Norman R. Ingraham, Jr. Am. Jour. Med. Sci., June, 1936, **191,** 819–827.

The author selected 131 out of a group of 258 syphilitic pregnancies for study, to determine the time interval or lag between fetal infection and the earliest roentgen demonstration of congenital osseous syphilis. He found that the earliest an osteochondritis can be recognized is about five weeks after the fetus becomes infected. A longer period, approximately four months, is required for the development of a syphilitic periostitis.

HENRY K. TAYLOR, M.D.

## SYRINGOMYELIA

Roentgen Therapy of Syringomyelia. L. Delherm. Strahlentherapie, 1936, **56,** 50.

The author reviewed the literature dealing with roentgen therapy of syringomyelia and found that of 160 cases reported, 124 (79 per cent) were considerably improved, while 32 (21 per cent) remained unchanged or grew worse later. In his own cases beneficial results were seen in about 60 per cent. Technic: 150 kv., 8–10 mm. Al, 200 r per sitting up to 1,000 r per series, interval between series 3–4 weeks, some patients receiving as much as from 15,000 to 20,000 r over a period of time without skin damage. The author treated 22 cases but seven of that number did not complete the treatment. Brief data on the remaining 15 are given: nine were improved, one case remained unchanged, and five grew worse in spite of the treatment. Roentgen therapy in syringomyelia is recommended.

ERNST A. POHLE, M.D, Ph.D.

## THROMBOPHLEBITIS

Roentgen Therapy of Thrombophlebitis. Fritz Eisler. Strahlentherapie, 1936, **56,** 228–233.

In the author's opinion radiation therapy of thrombophlebitis has been a successful treatment method. In the early stages of the disease it may subside within one or two days after therapy; in later stages of the disease it is possible to shorten its course. In acute cases roentgen therapy should be carried out only if it is possible to apply irradiation without moving the patient. Technic: 140–160 kv., 3 mm. Al or 0.3 mm. Cu + 1 mm. Al, depending on the depth of the affected vessels, 100 r over several areas, to be repeated up to five times at intervals of from three to eight days.

ERNST A. POHLE, M.D., Ph.D.

## THE THYROID

Radiation Therapy in Basedow's Disease. L. Brüll, B. van Pee, and P. Dumont. Strahlentherapie, 1936, **56**, 11.

The authors subjected 65 patients with Basedow's disease to irradiation. Forty-seven case reports are briefly quoted, covering observation periods of at least one and one-half years. Technic: 200 kv., 1 mm. Cu + 0.2 mm. Al, 4 ma., 40 cm. F.S.D., 300 r per sitting, two sittings per week, one field over each lobe, total dose per field 1,200 r. The larynx was carefully protected by 2 mm. of lead. Irradiation often reduced the size of the gland and the symptoms disappeared.

The radiosensitivity of different patients varies considerably and, therefore, no standardized treatment can be prescribed. The response to radiation therapy is usually delayed and does not manifest itself before two or three series have been given during a period of several months. In cases treated with radium a severe anemia occasionally sets in which can, however, be cured. In a few instances a slight myxedema may follow radiation therapy; female patients during the menopause seem to have a tendency to develop this complication. Among the 65 cases there was only one death. The authors feel that there is great similarity between surgical removal and radiation therapy of Basedow's disease. Both methods are considered rather crude and the hope is expressed that future progress will lead to the development of a more physiological method of treatment.

ERNST A. POHLE, M.D., Ph.D.

## THE TONGUE

Malignant Tumors of the Base of the Tongue. J. and L. Ducuing. Lyon Chir., November–December, 1935, **32**, 641–683. (Reprinted by permission from British Med. Jour., March 14, 1936, p. 44 of Epitome of Current Medical Literature.)

The authors discuss the pathology and treatment of malignant tumors of the base of the tongue, of which there are three different types: the infiltrating type, which is seen in about 20 per cent of cases; the ulcerating type, which is the most common, and the fungating form. The infiltrating type of growth is characterized by a thickening, covered with apparently healthy mucosa which subsequently ulcerates. The ulcerating type of tumor has a round or irregular outline, and is covered with grayish sloughs.

The growth of epithelioma of the base of the tongue is slow and the early symptoms are slight. Examination reveals at this stage a small nodule, but later on pain and difficulty in swallowing are experienced, accompanied by extensive salivation and fetid breath. In some cases treatment is sought only after several months, during which the symptoms have been slight, but only in early cases is the prognosis at all favorable.

As a rule, the tumor may be felt by means of digital examination, but radiography of the hypopharynx is helpful in some cases when the growth is inaccessible to the finger. In all cases biopsy should be practised, to confirm a diagnosis of malignancy.

As regards methods of treatment, surgery is ineffective and dangerous for the primary lesion, but is satisfactory for removal of the glands. Electrocoagulation is fairly satisfactory when the growth is not very extensive and is reasonably accessible. Radium needles become easily detached, and may cause lung complications. It is suggested that the radium bomb may be a useful method of treatment, but it has not been used long enough for results to be given. X-ray therapy is considered to be superior to radium as a method of treatment; it is suggested that irradiation should always be used for the glandular region, and also for the primary lesion. In cases in which the glands are only slightly affected, electrocoagulation may be used for the primary lesion.

## TUBERCULOSIS, PULMONARY

Casuistic Contributions Regarding the Appearance of Secondary Infiltration in the Course of Childhood Intrathoracic Tuberculosis. F. Lichtenhahn. Schweiz. med. Wchnschr., Feb. 1, 1936, **66**, 109–114.

Childhood tuberculosis involving the hilar lymph nodes is frequently accompanied by a more or less fugacious pneumonic infiltration in the adjacent pulmonic structure. This has been designated as peri-focal secondary infiltration, or as epituberculous infiltrate. The present concept is that this is a collateral exudative inflammation, in the contiguous environs, and an active tuberculous process which rarely and not necessarily results in caseous pneumonia. As a rule, this pneumonitis rather rapidly assumes a harmless course, disappearing entirely or leaving remnants of cicatricial tissue. The process occasionally occupies an entire lobe, or even a lung, and roentgenographically simulates a true lobar pneumonia. In certain instances, this parahilar pneumonitis and regional hilar lymphadenopathy, together with a negative von Pirquet reaction, have suggested the possibility that the appearance is resultant of pneumonitis about *Ascaria* embryos, in their temporary sojourn in the pulmonic parenchyma during their progress to the intestinal tract. This opinion, however, has had few adherents.

An important consideration of the above is the fact that contrary to prior opinion as to management and contagiousness of so-termed childhood hilar lymphadenopathy of tuberculous origin, and allergic manifestations in the lungs, there is ample proof that in any phase of intrathoracic tuberculosis, bacilli may be found in the sputum, which is usually scanty, feces, and laryngeal mucus, and particularly the gastric chyme. Guinea-pig inoculation is positive in a high percentage of cases.

The article is excellently illustrated with roentgenograms depicting metamorphosis of the vagaries of childhood tuberculosis, which lend weight to the author's deductions.

WILLIAM R. STECHER, M.D.

Roentgenoscopy *versus* Roentgenography of the Chest. A. Wernli-Haessig. Schweiz. med. Wchnschr., Feb. 1, 1936, **66,** 116–119.

In an extensive study of pulmonary tuberculosis, the author compared the incidence of correct diagnosis by roentgenoscopy with roentgenography, and noted a 10 per cent error in the former method. This emphasizes the fact that roentgenography is indispensable in an early diagnosis of pulmonary tuberculosis. Approximately one-half the errors were of the type in which no lesions were existent but one was "read in" by the roentgenoscopist. In the remaining cases, gross errors were committed. It is patent that even in the hands of the best trained roentgenoscopist, early lesions will be detected more often by roentgenography. The fact that numerous lesions were entirely overlooked by roentgenoscopy stresses the point that had not roentgenograms been obtained, these patients might have had possible rapid extension of the process without recognition thereof, until bilateral extension occurred and irreparable damage ensued. Roentgenoscopy is a valuable procedure when employed judiciously, and is indicated in every chest examination, as is well illustrated by an analogous analysis of cases examined by clinical and roentgenoscopic methods, respectively. Thus, in 90 cases there was no clinical diagnosis made of uni- or bi-lateral pulmonary tuberculosis, though it was noted roentgenoscopically. In every case of the entire series, the roentgenologic findings were far more extensive than clinical findings would suggest. The author goes into the minutiæ of the method of a proper roentgenoscopic examination, which does not differ essentially from methods used in America. He advisedly emphasizes the importance of detecting retrocardiac lesions, and pulmonic lesions situated in the neighborhood of the anterior and posterior costophrenic sulci, which can be easily overlooked in a single anteroposterior roentgenographic projection.

WILLIAM R. STECHER, M.D.

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Use of the X-rays in Pulmonary Tuberculosis from the Point of View of Prognosis. Francis B. Trudeau. Jour. Am. Med. Assn., Feb. 22, 1936, **106,** 592–595.

Much valuable information can be obtained from a careful study of roentgenograms of the chest in predicting the future trend of the disease and the patient's chance of ultimate recovery.

In 943 routine cases admitted within seven or eight years, only 3 per cent graded minimal on admission had died, while 15 per cent graded moderately advanced and 39 per cent graded far advanced had terminated fatally.

The soft, fluffy smoke shadow of the exudative type was compared with the more nodular, clean-cut, and stringy shadow of the proliferative type, and it was found that only 39 per cent of the former had made satisfactory progress while 91 per cent of the latter had done well.

In another group of 925 routine admissions, cavities were visualized roentgenographically in 42 per cent. At the end of five years, 35 per cent of these patients were dead, while of the remaining 533 patients only 20 per cent were dead. The percentage of deaths in patients with cavity was within 5 per cent of double that of those without cavity at admission. Under treatment in 36 per cent of 336 patients, the cavities remained approximately the same size. Of these, 34 per cent died within five years after leaving the sanatorium. In those in whom the cavities increased in size, 54 per cent were dead within a five-year period. Of those in whom the cavities decreased or had disappeared completely only 11 per cent succumbed within a five-year period.

In 600 consecutive admissions, the patients were followed from three to five years after their discharge. In those whose x-ray films showed a steady healing of their disease only 9 per cent were dead, while in those whose roentgenograms showed a progression of the disease 37 per cent died.

The author found that progression of the disease as shown roentgenographically was of much graver significance than in cases in which it was indicated by physical signs.

The extent of lung involvement greatly influences the prognosis in pulmonary tuberculosis, the death rate being in direct proportion to the amount of disease. Progression in serial x-ray studies suggests a prognosis equally unfavorable with that indicated by the presence of fever. Patients with both fever and progression in serial roentgenograms have six times as unfavorable an outlook as those who are free from fever and whose roentgen examinations show constant improvement.

CHARLES G. SUTHERLAND, M.B. (Tor.).

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Indirect Fracture of the Rib in Pulmonary Tuberculosis. Eric C. Richardson. Jour. Am. Med. Assn., May 2, 1936, **106,** 1543, 1544.

Twenty individuals showed fracture of one or more ribs, occurring as a result of muscular violence associated with coughing, from a series of 1,903 patients admitted over a five-year period. Ten additional cases were seen in the out-patient department.

Direct trauma was reasonably excluded in at least ten patients and there was no history in any case. Stimson mentioned the possibility of this accident in 1883. A review of the literature revealed a small number of reported cases.

CHARLES G. SUTHERLAND, M.B. (Tor.).

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Tuberculosis in Infancy and Childhood, with Special Reference to its Prevention. John W. S. Blacklock. British Med. Jour., Aug. 15, 1936, No. 3945, pp. 324–328.

The author investigated 434 cases with tuberculous lesions found in a series of 3,000 necropsies of children during the last twelve years at the Royal Hospital for Sick Children, Glasgow. Due to the uncomplicated character, and lack of immunity and allergy produced by previous tuberculous infection, it was relatively

easier to find the initial lesion, to follow its course, and to interpret the pathologic changes in children than in adults. In this series of 3,000 postmortem examinations the author found an incidence of 14.5 per cent of tuberculous infection. In the group of 434 cases of tuberculous lesions, 89.2 per cent died as a result of tuberculosis. It was noted that the greatest mortality occurred during the first two years and then decreased with the increase in age of the child.

A benign childhood tuberculosis has been generally regarded as producing some immunity to such infection in later life. However, in view of the fact that tuberculous infection during the first three years of life is so serious, it is believed extremely important to prevent such infection, if possible. The effect of childhood lesions on later infection is not thoroughly understood. The South African Rand report states that tuberculin-positive negroes are more likely to develop a recognizable tuberculosis than tuberculin-negative reactors but the latter show a greater liability to develop a septicemic type. Stewart and Myers and Harrington observed that tuberculin-positive children more frequently develop fatal phthisis in later life than those who react negatively.

The author believes that the effect of allergy as a result of infection acquired later in childhood is entirely different from that acquired in infancy. This difference may be due to the fact that the younger child is more intimately and more frequently exposed to familial infection and also possibly to the higher natural immunity possessed by the older child. While there is a considerable difference of opinion in this regard, the balance of evidence favors the view that minimal infection in later childhood probably affords some degree of protection against reinfection with small and infrequent doses of tubercle bacilli. The author is of the opinion that the indiscrimate and general use of B.C.G. vaccine as recommended by Calmette for producing immunity in children is a procedure of questionable value and of possible danger. The use of killed cultures of tubercle bacilli is not as objectionable, and has been shown to produce immunity in animals. However, some consider the specific allergy produced in infants by these immunizing vaccines definity unfavorable.

The main routes of infection by the tubercle bacillus are through the respiratory and alimentary systems. Infection occurred *via* the respiratory tract in 283 (65.2 per cent) of the 434 cases studied. The lesion noted in the lung was the rather typical small localized patch of caseous bronochopneumonia. This type of lesion is found only in the non-allergic individual. Parrot described this lesion 40 years before Ghon, although it has been called "Ghon's tubercle." In the group of 283 cases such primary lesions were found in 255 cases. These lesions were usually subpleural and in the right upper lobe. Healing of these areas was noted to be much more frequent in the older age groups. The tracheo-bronchial glands were involved in all cases. As a result of these studies the author concludes that it is the glandular lesions which are responsible for the dangers of these infections. He found dissemination of the infection more frequently in children under three years of age in whom glandular involvement was greater, than in older children Pulmonary tuberculosis was directly or indirectly the cause of death in 99.5 per cent of the children under three years, and in 89.3 per cent in individuals over three years of age.

The organisms responsible for the lung lesions were isolated and typed and it was noted that the human bacillus was chiefly responsible, while in only 3.6 per cent of cases was the bovine strain found.

In 149, or 34.3 per cent, of the 434 tuberculous cases, the portal of entry was *via* the gastro-intestinal tract. Death resulted from dissemination of the infection in 87.1 per cent in children under three years of age and in 29.8 per cent in children over three years of age. The organisms in this group were found to be in 82.2 per cent of cases of the bovine strain. Since it is relatively easier to prevent the alimentary form of tuberculosis than the respiratory form, every effort should be made to supervise the milk supply of children.

J. N. Ané, M.D.

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Hematogenous, Disseminated (Miliary) Tuberculosis of the Lungs, with Cure. C. Hegler and H. Holthusen. Röntgenpraxis, March, 1936, **8,** 161–169.

It is known that occasionally a miliary tuberculosis of the lungs has healed: nine such cases are reported by the authors. In all these patients roentgenograms, typical for miliary tuberculosis, showed a more or less normal appearance after some time. The clinical diagnosis was proved in most cases. The course of the disease was acute in some, chronic in others. Some of the patients died later from tuberculosis.

H. W. Hefke, M.D.

## TUBERCULOSIS, RENAL

The Early Diagnosis and Treatment of Renal Tuberculosis. Kurt Tzschirntsch. München. med. Wchnschr., April 24, 1936, **83,** 684–688.

Isolation of the tubercle bacillus by means of ureteral catheterization does not necessarily mean that the kidney is diseased, for a normal kidney may filter out tubercle bacilli from an infected contralateral kidney or *via* pulmonary tuberculosis. A survey roentgenogram of the renal regions may reveal irregular calcification near the cortical outlines of the kidneys, suggestive of renal tuberculosis. Retrograde pyelography is a most important procedure, and early changes in calyceal outline are readily demonstrable. An accompanying irregularity of the ureteral outline and the bladder appearance are confirmatory evidence of tuberculous ureteritis and cystitis. It should be remembered from a clinical standpoint that any cystitis which does not respond to the usual therapeutic procedures should be considered as tuberculous until proven otherwise. Intravenous urography is to be employed only when retrograde pyelography cannot be undertaken, *viz.*, in cases of marked cystitis and ureteritis, such as do not permit

the passage of a catheter. This procedure, however, is valuable in determination of function of the opposite kidney. An early diagnosis indicates nephrectomy, which is attendant with excellent results.

WILLIAM R. STECHER, M.D.

## TUMORS (DIAGNOSIS)

Multiple Myelomas with Tumor-like Amyloidosis: A Clinical and Pathologic Study. A. H. Rosenblum and J. D. Kirshbaum. Jour. Am. Med. Assn., March 21, 1936, **106,** 988–991.

The association of amyloidosis with multiple myelomas has been noted with increasing frequency in recent years. A review of the literature revealed 39 cases.

Amyloidosis may be classified as follows:

(1) Primary or osteopathic amyloidosis, in which there is no apparent underlying suppurative or neoplastic condition. In this group there are two forms: (*a*) The diffuse or typical form, as it occurs in the liver, spleen, kidneys, and so on—associated diffuse involvement of the bone marrow has been described by Gerber; (*b*) the localized or atypical form, in which a tumor-like amyloid deposit is present in the larynx and the base of the tongue, the muscles, trachea, and lung. These tumors may also be multiple and may be combined with the diffuse form.

(2) Secondary or symptomatic amyloidosis, in which a known pre-existing cause is present, such as tuberculosis, neoplasms, or chronic suppurative processes. In this group there are two forms: (*a*) Diffuse involvement affecting typically the liver, kidneys, spleen, and adrenals, or atypically in sites that are usually spared, as the viscera, muscles, and bone marrow; (*b*) localized involvement, which may occur within neoplasms, or chronic inflammatory areas as in the form of tumor-like amyloid deposits, especially in the upper air passages.

Combinations of these types are frequently present.

In reporting a case, the authors conclude from their own experience that in cases appearing as primary or so-called idiopathic amyloidosis, either local or diffuse, repeated biopsies are advisable to exclude the possibility of an underlying myeloma. In all cases of multiple myelomas, the congo red test should be performed in order to detect an eventually associated amyloidosis. In multiple myelomas, instead of the typical Bence-Jones protein, atypical proteins may be found in the urine, possessing the same diagnostic significance as the former.

CHARLES G. SUTHERLAND, M.B. (Tor.).

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Multiple Symmetrical Lipomatosis. J. K. Miller. Jour. Am. Med. Assn., June 13, 1936, **106,** 2059, 2060.

Lipomas may occur anywhere within the body and have been found in the cranial cavity, the mediastinum, the uterus, and the marrow cavity of the bones. Because of their wide distribution they have been classified as subcutaneous, intermuscular, and visceral. The majority are located under the skin and occur most frequently in the trunk, thighs, and arms. The face, scalp, sternal region, hands, and lower legs are infrequent sites. Three cases of multiple symmetrical lipomatosis observed in a mother, a son, and a daughter are presented. The tumors were noted in uncommon sites, namely, the head and lower part of the legs, on the mother and son. The distribution of the tumors in the son and daughter was similar. Possible endocrine disturbance may have been an etiologic factor in the mother.

A review of the literature shows the etiology of symmetrical lipomatosis to be obscure. A number of writers have linked the lipomas with neuropathies. Endocrine imbalance, particularly of the thyroid and pituitary, may be provocative agencies. A heredofamilial tendency has been noted. Adair reported the condition extending through three generations. He differentiated between multiple lipomas and "congenital diffuse lipomatosis." The latter is confined to one or two limbs and is usually associated with corresponding enlargement of muscles and bones of the same extremity. He considers multiple lipomas to be neurolipomas. They are not congenital but develop during adolescence and later life. Their frequent symmetrical distribution commonly confuses them with multiple neurofibromatosis. In suggesting a neurogenic origin for multiple lipomas, he admits a lack of histologic evidence.

CHARLES G. SUTHERLAND, M.B. (Tor.).

## TUMORS (THERAPY)

A Case of Plasma-cell Myeloma with One Single Focus. A. Rosselet and P. Decker. Strahlentherapie, 1936, **56,** 337–340.

The authors report a case of plasma-cell myeloma which involved the fifth to the seventh cervical vertebræ. The diagnosis was verified by biopsy; the tumor was then incompletely removed. X-ray therapy was given post-operatively, after which the patient remained alive and well for four years without developing new foci. A recent recurrence responded well to radiation therapy.

ERNST A. POHLE, M.D., Ph.D.

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The Problem of Acquired Radioresistance in Epithelial Tumors. Simone Laborde. Strahlentherapie, 1936, **56,** 466–477.

The author describes a number of cases illustrating the phenomenon of acquired radioresistance. A recurrence following previous irradiation, or failure of the tumor to disappear after the first series of treatments, presents difficult problems to the radiologist. It seems imperative to bring about healing with the first treatment or with two series closely following each other. There are several hypotheses advanced which attempt an explanation of the phenomenon, but none has histologic proof for its support.

ERNST A. POHLE, M.D., Ph.D.

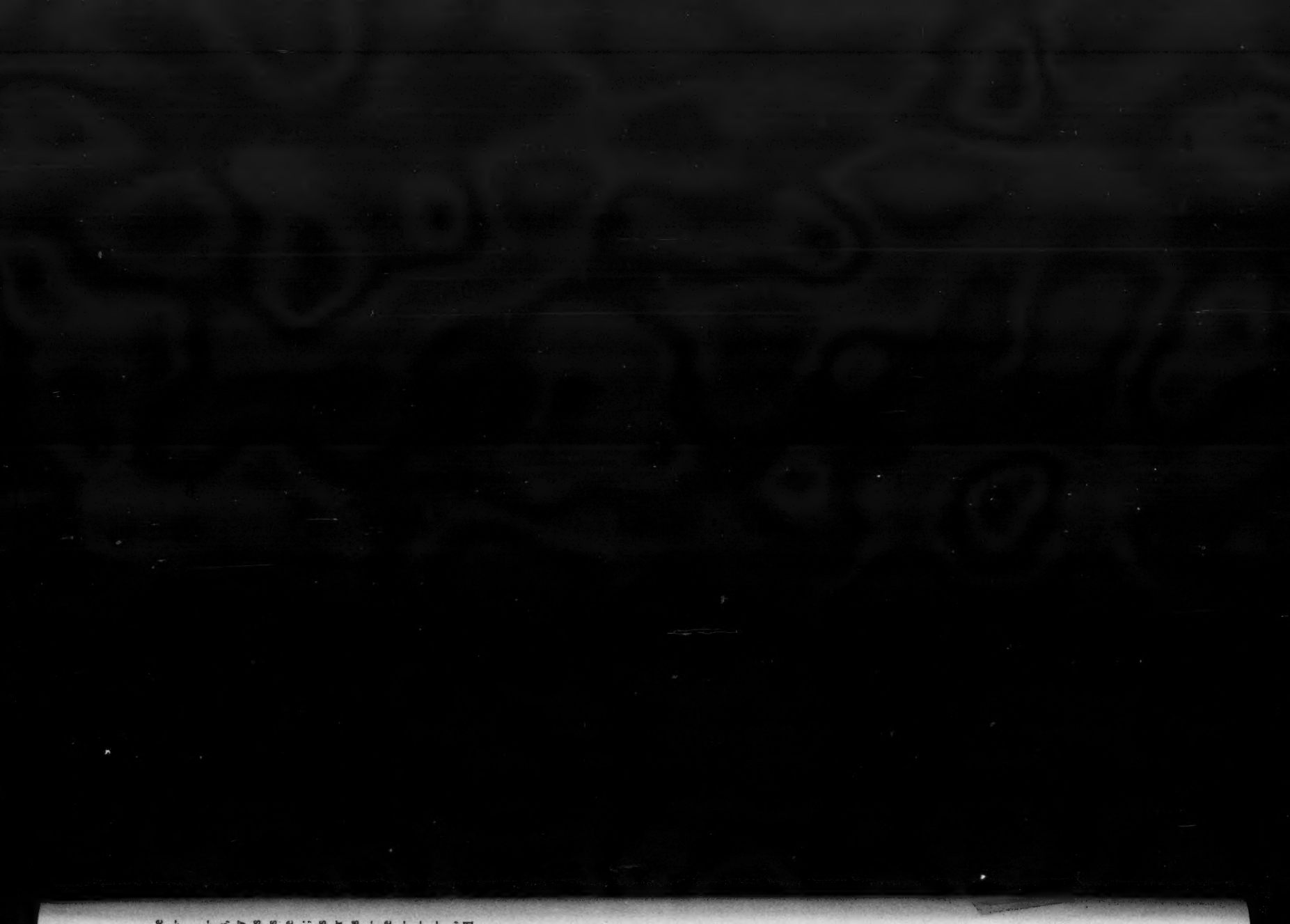
## THE UTERUS

Indications and Treatment Methods in Radiation Therapy of Uterine Fibroid. G. Gambarow. Strahlentherapie, 1936, **56**, 75.

The author briefly discusses the indications and various treatment methods practised in leading clinics in radiation therapy of uterine fibroids. After an analysis of his experience in over a thousand cases he concludes that in uterine bleeding due to fibroid or metropathia roentgen therapy should not be used in patients under 40 years because of the severe climacteric symptoms. In patients under 40 years he chooses either operation or radium therapy. Diagnostic curettage must be done before using irradiation. In very large uterine fibroids operation is considered by the author as the method of choice. He also feels that radium therapy is in some cases preferable to roentgen therapy because the bleeding stops much quicker and the menopausal symptoms are not so severe.

ERNST A. POHLE, M.D., Ph.D.

Early Diagnosis of Carcinoma of the Cervix by the Colposcope. M. Kranzfeld. Schweiz. med. Wchnschr., Feb. 29, 1936, **66**, 223–225.

By means of this instrument devised by Hinselmann, one can view the cervix enlarged ten diameters, and this affords an excellent method of detecting early carcinomatous changes. The author reports two cases in which the diagnosis was established only by this method. Furthermore, the colposcope enables one to obtain proper biopsy, by directing to the proper site; and in instances the entire incipient carcinomatous process was included in the biopsy specimen. After reviewing over 1,500 colposcopies, the author disagrees with Hinselmann, in regard to certain so-termed precancerous lesions, *viz.*, leukoplakia, and iodine negative test regions. In reviewing these cases over a three-year period, not one case presented evidence of malignant change. The colposcope is an exceedingly valuable addition to the armamentarium of the physician, but should be employed only by skillfully trained specialists.

WILLIAM R. STECHER, M.D.